INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR HM-3719 COLOR MONITORS

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1. INTRODUCTION

1.1 TECHNICAL FEATURES

The HM-3719 color monitor is designed to be an economical, highperformance color monitor with in-line gun and provides the following features :

a. High Resolution

Clear and sharp pictures obtained from 0.012" (0.31mm) dot pitch and wide video bandwidth 40 MHz.

b. Self Convergence Adjustment

Self convergence in-line gun eliminates trouble some adjustments.

c. Simple Configuration

PC board assures high reliability and easy maintenance.

d. Wide Range Input Voltage.

Input voltage (90-132V/180-264V) adjustable without soldering iron provide the easy adjustment of the monitor.

e. Stable Picture

Low power consumption in-line gun and high voltage stability provide the stable picture and long life operation.

1.2 TECHNICAL SPECIFICATIONS

1.2.1 CRT Specifications

1.	Screen Size	:	19V inch diagonal
2.	Electron Gun	:	Precision In-Line
3.	Convergence	:	Self-convergence
4.	Dot Trio Pitch	:	0.31 mm
5.	Deflection Angle	:	90 degree
6.	Phospher	:	Long Persistance
7.	Surface & Glass	:	Normal surface clear glass (Standard.) With Anti-Reflection Coating Panel (Optional.)

1.2.2 Signal Input

1.2.2.1 Video Signal

a) Type : Red - R
Green - G
Blue - B

Composite sync. signal is taken from the Green video signal line.

b) Level : Non-Composite : 0.7 Vp-p nominal (0.35-1.2 Vp-p)

Composite : 1.0 Vp-p nominal (0.5-1.5 Vp-p)

c) Polarity : R.G.B. : Positive bright

SYNC. : Negative

d) Impedance : 75 ohms
or High impedance switch selectable

e) Connector : Three BNC receptacles (One each for R.G. and B.)

1.2.2.2 Sync Signal

a) Type : Composite on Green signal or External (H & V mixed) without any switch-over operation.

b) Level : Composite : 1.0 Vp-p nominal (0.5-1.5 Vp-p) Video plus sync

Sync. to total signal ratio : 28.6±5%

External : 4.0Vp-p nominal (1.0-5.0 Vp-p)

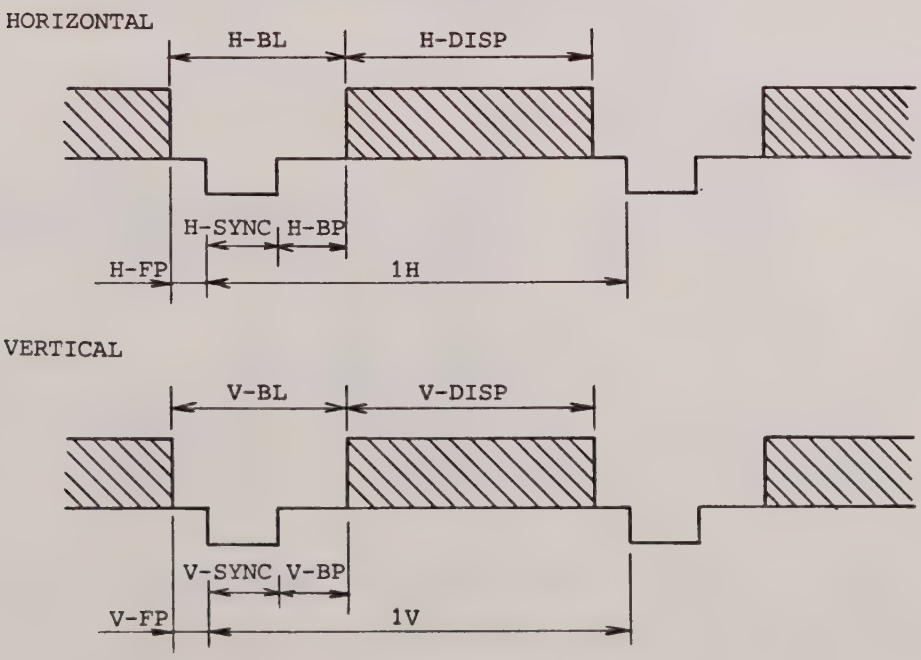
c) Polarity : Negative

d) Impedance : 75 ohms or High impedance switch selectable

e) Connector : BNC receptacle (Ext. Sync.)

1.2.2.3 Signal Waveform : EIA RS-343A or RS170 Compatible (Refer to SIGNAL TIMING CHART.)

SIGNAL TIMING CHART



	ITEM	EQUATION	MONITOR REQUIREMENT	RATING	UNITS
a	Resolution H			1024	Pixels
b	Resolution V			800	Pixels
c	Pixel rate			(22.0)	ns
d	Pixel freq.	1/c		45.5	MHz
e	H-DISP	axc		22.51	µs
f	H-BL	g+h+i	6.5 - 7.0*	7.03	µs
g	H-FP		0.25 - 1.0	0.7	µs
h	H-SYNC		1.5 - 4.0	3.5	µs
i	H-BP		≧2.0	2.8	µs
j	1H	e+f	29.4 - 30.3	29.54	µs
k	H. freq.	1/j	33 - 34	33.85	kHz
l	V-DISP	bxj		400H	ms
m	V-BL	n+o+p	27H - 33H	27H	ms
n	V-FP		0H - 3H	0H	ms
o	V-SYNC		3H - 6H	3H	ms
p	V-BP		24H - 30H	24H	ms
q	1V	l+m	12.2 - 17.2	427H	ms
r	V. freq.	1/q	58 - 82	79.3	Hz

* When more than 7.03 µsec. of H-BL will be applied, 346 mm in horizontal of active display area may not be achieved.

1.2.3 Visual Performance

1.2.3.1 Display Area : 346mm (13.62") × 270mm (10.63") ±2% of Rated Timing

1.2.3.2 Resolution : 1,024 × 800 Interlaced

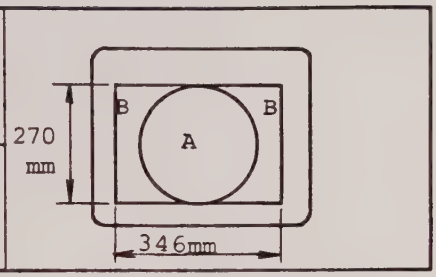
1.2.3.3 Linearity : With test signal (1" pitch closs-hatch) applied, the maximum and the minimum interval anywhere on the screen is

$$\frac{MAX - MIN}{MAX + MIN} \leqq 7\%$$

(Horizontally and Vertically)

1.2.3.4 Misconvergence :

Zone A	MAX. 0.4mm
Zone B	MAX. 0.7mm



1.2.3.5 Black Level Stability : Less than 1% of peak luminance from 10% to 90% APL (Average Picture Level).

1.2.3.6 Raster Distortion : $\frac{MAX - MIN}{MAX + MIN} \leq 1\%$

(Horizontally and Vertically)

1.2.3.7 Raster Size Regulation : Less than 1.0% of maximum raster dimension change with a 0 to 100% APL.

1.2.3.8 Brightness : More than 15 Ft-L
(normal surface clear glass)

More than 12 Ft-L
(with A/R coating panel)

1.2.3.9 Emission Warm-up Time : Less than 20 seconds.

1.2.4 Electrical Specifications

1.2.4.1 Scanning Frequency : Horizontal 33.5±0.5 kHz
Vertical 58 - 82 Hz

1.2.4.2 Retrace Time : Horizontal 6 µsec. maximum.
Vertical 800 µsec. maximum.

1.2.4.3 Video Amplifier

a) Bandwidth : ±3 dB from 50 Hz to 40 MHz.

b) Pulse Response Rise/Fall time : 10 ns maximum.

c) Overshoot : No greater than 10% of full scale.

1.2.5 Input Power Requirement

1.2.5.1 Input Voltage Range : 90 - 132 V AC (Tap selectable)
180 - 264 V AC

1.2.5.2 Frequency : 47 - 63 Hz

1.2.5.3 Power Consumption : 150 watts maximum

1.2.5.4 Power Receptacle : CEE-Publication 22 6A, 250V

1.2.5.5 Inrush Current : Power ON : Less than 40A

Manual Degaussing : Less than 20A

1.2.5.6 Heat dissipation : 510 BTU/hour nominal

1.2.6 Mechanical Outline

1.2.6.1 Dimensions : Refer to Fig. 1-1.

1.2.6.2 Weight : Approx. 59 lbs. (27kg) with A/R Coating Panel

55 lbs. (25kg) Normal surface clear glass.

1.2.6.2 External dimensions : as per Figure 1-1 ∿ 1-2.

1.2.7 Environmental Conditions

1.2.7.1 Ambient Temperature : Operating 0°C to 50°C
Storage -30°C to 65°C

1.2.7.2 Humidity : Operating 10 to 90% non-condensing
Storage 10 to 90% non-condensing

1.2.7.3 Altitude : Operating 3,050 m (10,000 feet)
Shipping 10,500 m (35,000 feet)

1.2.7.4 Shock : 10 G

1.2.7.5 Vibration : 0.6G at 1000 rpm

1.2.7.6 Warm-up Time : 30 minutes (Time to get display performance specified here.)

1.2.8 Regulations

1.2.8.1 X-Ray Radiation : Less than 0.5 mR/Hr, comply with DHHS rules 21 CFR, Sub-chapter J.

1.2.8.2 EMI : FCC class A, commercial, industrial or business environment.

1.2.8.3 UL : UL 478 safety specification for Electronic Data Processing Units and Systems.

1.2.8.4 CSA : CSA C22.2-154 Safety requirements for Data Processing Equipment.

1.2.9 Reliability

1.2.9.1 Calculated MTBF : 26,000 Hours at 25°C based on MIL HDBK-217C.

1.2.10 Controls and Connectors

1.2.10.1 PC Board

Height potentiometer

Width potentiometer

Vertical hold potentiometer

Horizontal hold potentiometer

Red background potentiometer

Green background potentiometer

Blue background potentiometer

etc.

1.2.10.2 Remote Panel Interface (Side Flying Connectors)

Flying connectors are provided to enable remote connection of the monitor's Power ON/OFF switch, Brightness control and Degaussing switch and Power on indicator features.

Recommended parts and interface specifications for Remote Panel are as per Fig. 1-3.

1.2.11 Type No.

Model number indicates the following optionals :

HM - 3719 - (a) - (b) (c)

(a) Mechanical configuration

F : Bare-type with flying connectors for Remote Panel.

(b) Picture tube

D : Long persistance phospher, normal surface clear glass.

C : Long persistance phospher with Anti-Reflection coating panel.

(c) Electrical Specifications

A : Standard

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The drawing history is recorded in DWG.NO. EB-RA11174

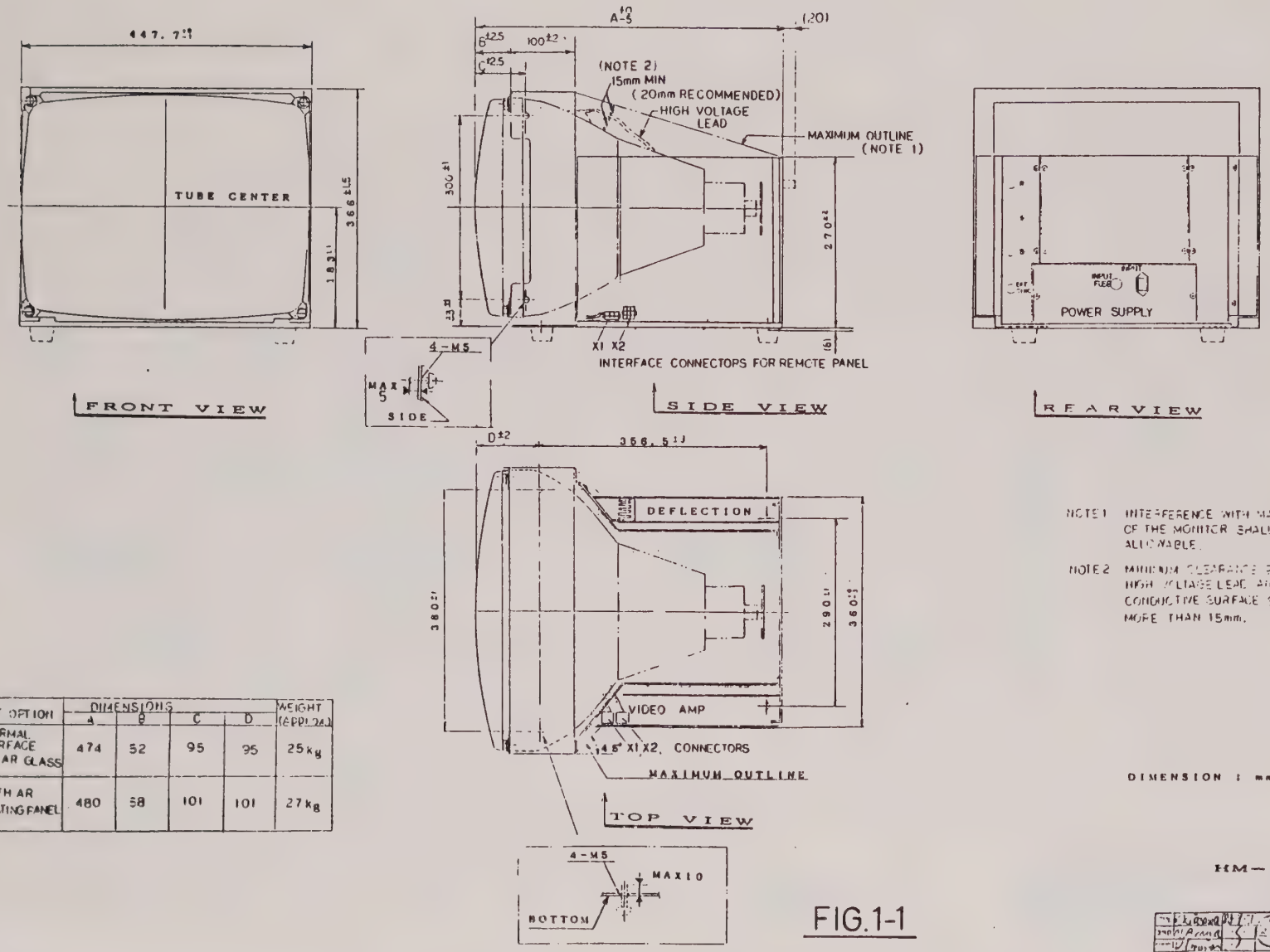


FIG.1-1

CRT OPTION	DIMENSIONS A	B	C	D	WEIGHT (APPROX.)
NORMAL SURFACE CLEAR GLASS	474	52	95	95	25kg
WITH AR COATING PANEL	480	58	101	101	27kg

NOTE 1 INTERFERENCE WITH MAXIMUM OUTLINE OF THE MONITOR SHALL NOT BE ALLOWABLE.

NOTE 2 MINIMUM CLEARANCE BETWEEN HIGH VOLTAGE LEAD AND ANY CONDUCTIVE SURFACE SHALL BE MORE THAN 15mm.

DIMENSION : mm

HM— 3719

TITLE EXTERNAL DIMENSIONS

Hitachi,Ltd TOKYO JAPAN

331R X10894

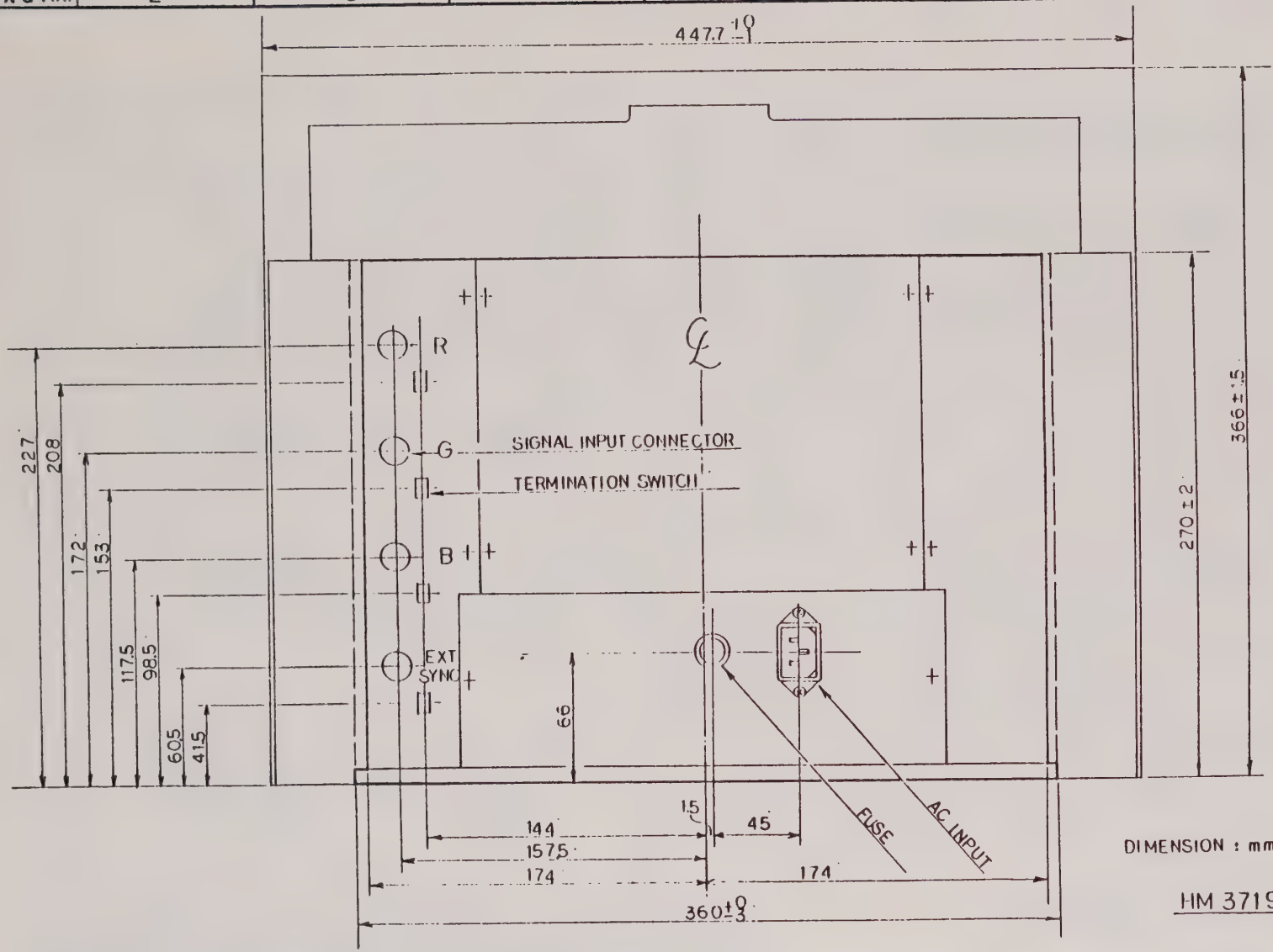


FIG.1-2

DWN	K.Kitazawa	84-3-1		TITLE	REV.
CHKD	Y.Tomita	"		REAR PANEL LAYOUT	
APD	T.Yoshida	"			
Hitachi, Ltd. Tokyo Japan				CMPA MODEL D. C. NO. 331 DX31872	PAGE

DX31872

NO.	Connector NO.	HM-3719 MONITOR	REMOTE PANEL (Provided by user) Connection
1	X1	INPUT CONNECTOR, FUSE, X1, POWER SUPPLY, POSISTOR, DEGAUSS COIL, (X1), POWER ON/OFF SWITCH, DEGAUSS SW, X1, FLYING LEAD, X1	
2	X2	X2, 12V, 5.1kΩ, 100Ω, 470Ω, 820Ω, 3kΩ, 0.1μF, (X2), BRIGHTNESS, 5kΩ, CLOCKWISE, POWER INDICATOR, X2, FLYING LEAD, X2	

PARTS NAME	REQUIRED RATING	RECOMMENDED PARTS TYPE	MAKER	REMARKS
Connector Housing	——	172339-1	AMP	
Contact	——	170365-1 / 170366-1	AMP	WORKING TOOL 724649-1 / 724651-1
Power ON/OFF Switch	AC125V(20A) / AC250V(10A)	SW-3006A UL,CSA	Nihon Kaiheiki Ind. Co., Ltd.	
Degauss Switch	AC125V(10A) / AC250V(5A)	SB-61A UL	Nihon Kaiheiki Ind. Co.,Ltd.	
Wire	AWG20	UL1015-20AWG (Yellow)	Hitachi Cable Ltd.	
Connector Housing	——	172340-1	AMP	
Contact	——	170365-1 / 170366-1	AMP	WORKING TOOL 724649-1 / 724651-1
Brightness VR	5 kΩ Liner Scale	EVV-G0AF20B53	Matsushita Electronic Component Co., Ltd.	
Brightness VR Knob	——	HB17S	Marusan	
Power Indicator	——	RD1301R	Okaya Electric Industries Co.,Ltd.	
Wire	AWG22	UL1007 22AWG (Blue)	Hitachi Cable Ltd.	

MAKER (JAPAN)	ADDRESS	TEL
AMP	7-15-14 Roppongi Minato-Ku Tokyo Japan	Tokyo 03 (404)-7171
Matsushita Electronic Components Co.,Ltd.	1006 Kadoma Kadoma-shi Osaka Japan	Osaka 06 (908)-1121
Okaya Electric Industries Co.,Ltd.	1-8-3 Shibuya Shibuya-ku Tokyo Japan	Tokyo 03 (400)-8511
Hitachi Cable Ltd.	2-1-2 Marunouchi Chiyoda-ku Tokyo Japan	Tokyo 03 (216)-1611
Nihon Kaiheiki Ind. Co.,Ltd.	1-5-14 Minamimagome Ohta-ku Tokyo Japan	Tokyo 03 (774)-0611
Marusan	1-11-2 Sotokanda Chiyoda-ku Tokyo Japan	Tokyo 03 (253)-0411
Fujisoku Electric Co.,Ltd.	1890 Kizuki-Sumiyoshi-cho Nakahara-ku Kawasaki-shi Kanagawa Japan	Kawasaki 044 (433)-5720

REMOTE PANEL INTERFACE FOR HM-3719

FIG.1-3

DRN	K.Kitazawa	84.3.7	TITLE	REMOTE PANEL INTERFACE
CHKD	K.Tomita			
APPD	I.Yoshida			
Hitachi, Ltd. Tokyo, Japan			331 DX30127	

2. INSTALLATION

2.1 PRECAUTION

2.1.1 Installation Precaution

The convergence of color monitor is subject to the influence of external inductive fields. Avoid installing the unit in areas where inductive fields are present. The following additional items will ensure proper monitor operation :

a. Ventilation :

For long time stable operation the temperature inside the case must be kept below 50°C.
Specifically, when this monitor is mounted in a cabinet, it must have vertical ventilation, both above and below. If there is insufficient space between the monitor and its surroundings, a cooling fan is recommended.

b. Leakage flux :

Do not install the monitor in areas where a transformer, fan or other leakage flux source will be nearby. The AC leakage flux causes oscillation of the picture, and DC flux (magnet or the like) causes raster distortion and makes the purity of the picture worse.
If it is necessary to mount such a device in these emvironment the following minimum requirements must be met. For a transformer, attach to it a shield ring and shorting ring, and design its windings in a balanced type to minimize leakage flux. For devices other than transformers, minimize leakage flux by means of a magnetic shield or

non-inductive windings.

The color monitor is susceptible to the influence of external magnetic fields.

To eliminate misconvergence avoid installing the unit close to an inductive magnetic field.

A magnetic field of more than 0.01 gauss which will cause noticeable distortion.

c. High vibration :

Although this monitor is designed to withstand vibration, it is still advisable to mount it on a vibration preventive base for long-time stable operation especially when it is installed on a vehicle or the like. The same caution should be exercised when there is a source of vibration in the vicinity.

d. Humidity :

This monitor can be operated within a relative humidity range of between 10 and 90%.

If it is operated in a humid environment for a long time, however, its life time may be shortened by deterioration of connector contacts or rheostats. It is, therefore, advisable to operate the unit in a humidity range of between 30 and 70%.

e. Ambient illumination :

This monitor employs a black matrix color picture tube which provides excellent resistance to glare or reflection in high ambient light.

It is, however, still advisable to avoid direct light sources shining onto the CRT screen in order to prevent eye fatigue.

f. Dust :

This monitor is designed to minimize dust collection. PCBs carrying major components are arranged vertically, however, because of the high static electric fields, dust will be attracted through the cabinet ventilation holes. Precautions, therefore should be taken to minimize dust in the vicinity.
It is advisable to periodically clean the anode cap of the CRT which tends to collect dust electrostatically.

g. Power voltage

The picture is not influenced by a voltage fluctuation within specification, because this monitor incorporates a voltage regulator circuit.
Operation over +10 % should be avoided, however, because of excessive heating in the interior and incidental detriment to the life time of the unit.
Either 50 Hz or 60 Hz can be sued without any modification of the unit.

h. CRT screen dirt

The explosion-proof CRT used in this unit has no front protective glass.
Therefore, dirt on the CRT screen can easily be wiped off.
As hypertension is applied, the CRTscreen tends to

collect dirt, which degrades brightness and focus. Use of soft cloth dampened with a silicone type glass cleaner is recommended for periodic removal of this dirt. Do not use a thinner or the like instead of a cleaner.

The static charge on the CRT screen may result in a shock if the screen is touched in a low-humidity environment. To avoid this, prepare a wet towel (wrung tightly), touch one end of it to the case and the other end to the CRT screen and press lightly to cause discharge.

2.1.2 Safety Precaution

a. Dangerous voltage exists within the display unit and the pedestal.
   Normal electrical precaution should be observed whenever working within those units while the cover are removed.

b. Disconnect the power source of the monitor, before removing or replacing circuit cards and components.

c. Caution must be exercised during the replacement or servicing of the CRT since a residual electrical charge may be contained on the anode button.
   Be sure to ground the soldering iron and measuring instruments.

d. The soldering tool and measuring instruments should be grounded.

e. Always use the manufacturer's replacement components, especially critical components as indicated on the circuit diagram should not be replaced by other components of other makes.

f. When replacing a chassis in the unit, all the protective devices must be put back in place, such as barriers, non-metallic knobs, adjustment and compartment cover-shields isolation resistor-capacitor, etc.

2.1.3 Product Safety Notice

Many electrical and mechanical parts in the color display units have special safety related characteristics.
These are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Manual.

Electrical components having such features are identified by a special marking on the schematics and on the parts list in this Manual.

The use of a substitute replacement component which does not have the same safety characteristics as a recommended replacement one, shown on the parts list in this Manual, may create shock, fire, X-radiation, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult this Manual.

a. X-radiation

This unit complies with U.S. Department of health, and human services X-ray radiation safety rules, 21 CFR, subchapter J.

TUBE : The primary source of X-radiation in this unit is the CRT tube. The tube utilized in this unit is specially constructed to limit X-radiation emissions. For continued X-radiation protection, the replacement tube must be the same type as the original type.

2.1.4 Information to User for FCC

This equipment complies with the requirements in part 15 of FCC Rules for class A computing device under following condition. Therefore please keep following condition to use this monitor.

(1) For video signal cables, double shield coaxial cable (FCC shielded cable) should be used as video signal cable and the outer shield should be connected to the earth.

or

In case of use of normal coaxial cable for video signal cable, the cable should be shielded with metal pipe or similar way for reduction of interference noise.

(2) For rackmount type, metal cabinet should be used

for reduction of interference noise. Approximate one (1) to two (2) mm thickness is adopted to cabinet type monitor as usual. Please prepare cabinet to be thick enough for the shielding purpose.

2.2 UNPACKING

2.2.1 Package

The monitor is packaged in a carton box and its dimensions and weight are as follows.

Dimensions :

Width	590 mm
Height	620 mm
Depth	700 mm

Weight :

	Net Weight	Gross Weight
With A/R Coat	27 kg	38 kg
Without A/R Coat	25 kg	36 kg

Standard accessories of 1 fuse and 1 manual are also packed in the carton box.

2.2.2 Unpacking

a. The packing weight of the carton box is more than 30 kg. Therefore it is recommended that it be handled by two men.

b. Unpack the monitor carefully and do not scratch or strike the picture tube face.

c. Please read the following section before connecting the color monitor to any AC power supply.

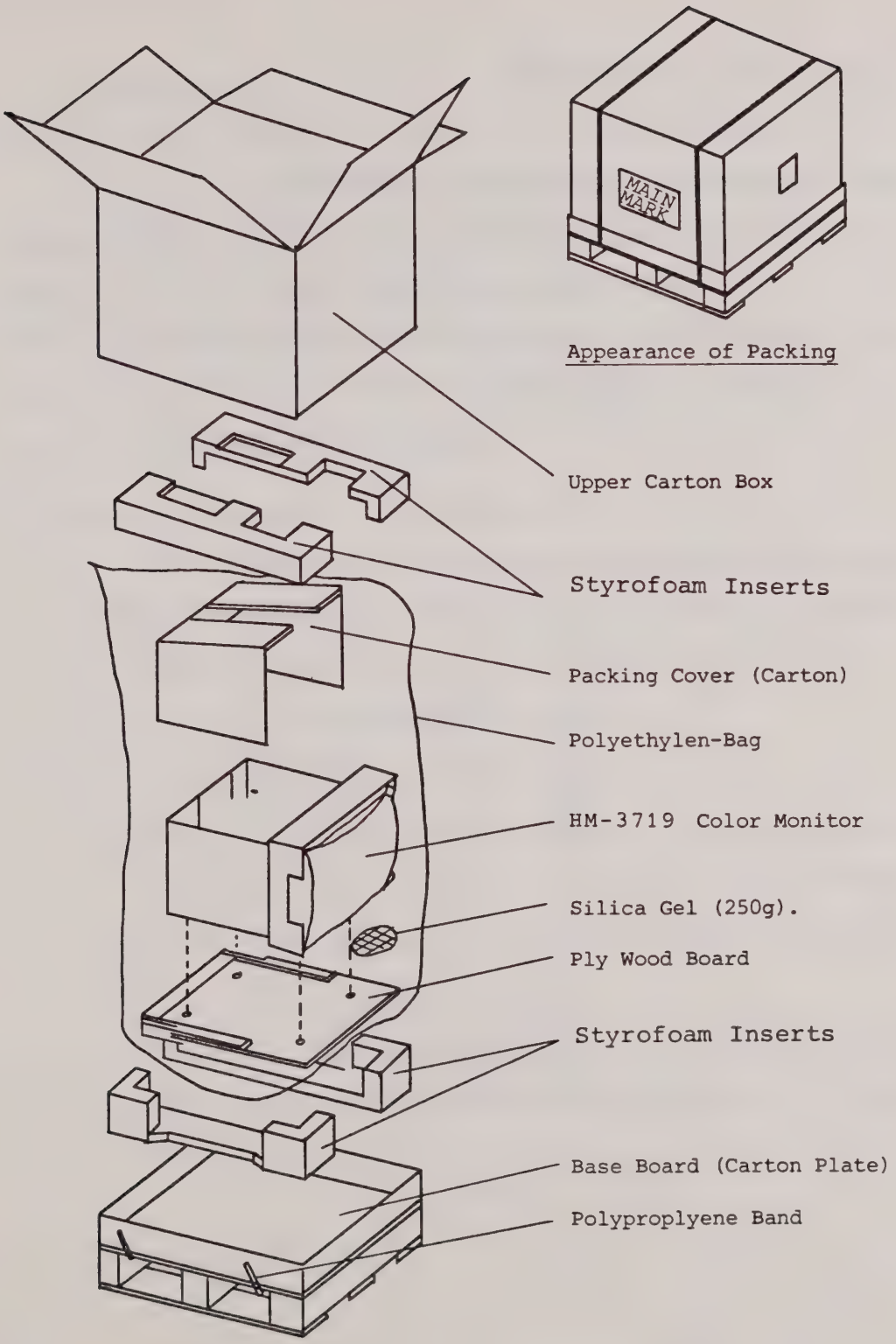


Fig. 2-1 Packing Procedure

2.3 MOUNTING INSTRUCTIONS

To prepare monitor for mounting, remove the plywood board used for shipping as following procedure.

(1) Carefully lay monitor on its side (90° angle)

(2) Remove four screws located on plywood board.

(3) Support monitor with one hand while removing playwood board to avoid sudden movement of monitor.

(4) Carefully return monitor to upright position.

The monitor can be mounted on a flat surface by fastening four screws to the bottom plate of the unit.
Dimensions of the base are shown in Figure 2-2 below.

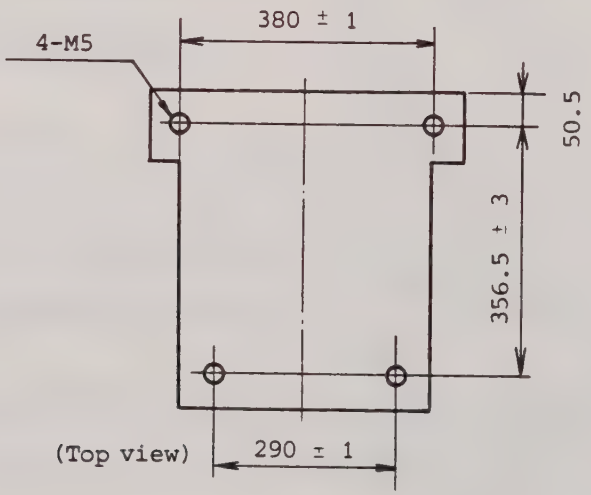


Fig. 2-2

2.4 INTERFACING

2.4.1 Remote Panel

The power on-off switch, brightness control switch and Degaussing switch for this equipment should be supplied by the users side, unless otherwise specified.

Mount these switches on the remote panel, and connect the lead wires of the switches to the following connectors X1 and X2 mounted on the equipment:

a. Connector X1

For connection of the power on-off switch which, when turned on, will supply operating power to the monitor, and the Degaussing switch which, will activate the Degaussing Circuit.

b. Connector X2

For connection of the brightness control switch by which the black level of picture on the CRT screen is changed, and a pilot lamp which indicates power on.

c. Recommended parts and detailed interface specifications for Remote Panel are as per Figure 1-3, in Section 1.

2.4.2 Signal Input (Rear Side Panel)

2.4.2.1 Input Signal

Connect red, green and blue video to the appropriate video input connectors on the rear connector panel as shown in Figure 2-3.

The video cables must be constructed with 75-ohm coaxial cable, and terminated at the monitor cable end with standard BNC connector plugs.

Synchronous input is possible for both composite sync on green signal and mixed external synchronous signal without any switchover operation.

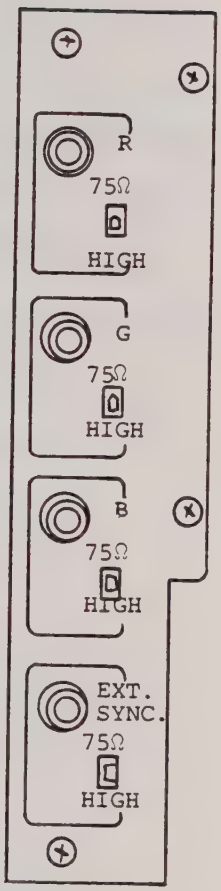


Fig. 2-3 Rear Panel Configuration

2.4.2.2 Termination Switches

There are switches which select the line impedance, that is 75Ω or High (Impedance) respectively for each input signal.

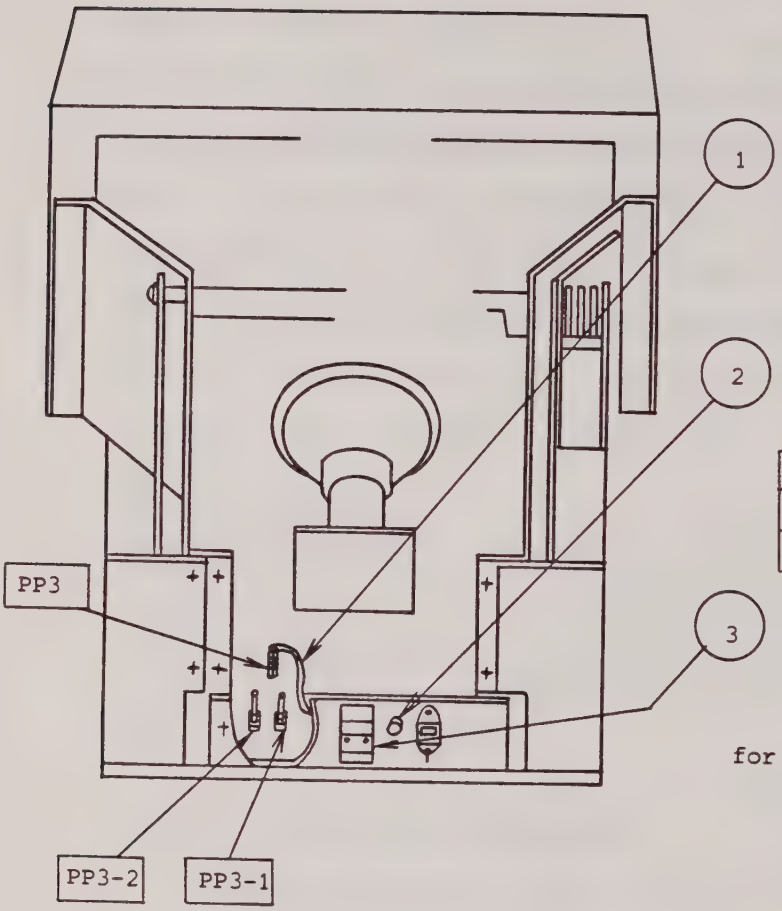
75Ω coaxial cable is used as signal cable. Switch shall be set to 75Ω termination side.

For loopthrough connection, a T connector may be used, and High impedance shall be selected except in the case of the last monitor in line.

2.4.3 AC Power Source

This HM-3719 color monitor is designed to operate under the AC power rating as 100-120V/200-240V AC and selection of one of these condition is achieved by switch-over of internal connector in the power supply module.

In order to adapt the monitor to other Power Line Voltages, please note the following. (Fig. 2-4)



1

Change the switch-over connection in the Power Supply module

Rating	Connection
120V AC	PP3 to PP3-1
240V AC	PP3 to PP3-2

2

Change the fuse according to the AC input rating

AC input rating	Fuse rating
120V AC	4A
240V AC	2A

3

Change the rating identification plate on the rear panel.

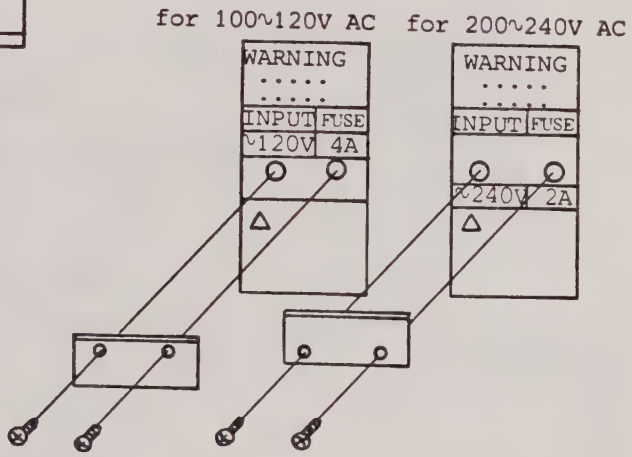


Fig. 2-4

2.5 INSTALLATION CHECKOUT

Connect the monitor to an AC power source and turn the POWER switch to the ON position.

Display a test pattern or some other suitable video signal to the video inputs.

There is normally a twenty (20) seconds delay from power on time to stable picture performance.

Adjust the brightness for the desired viewing level.

If the color purity or the convergence appear to be slightly out of adjustment, depress the Degaussing switch, hold it for several seconds and then release it. Note the action of the degauss circuit.

If the monitor does not display an image, or if the displayed image is distorted and cannot be corrected, please refer to the maintenance procedures given in Section 6.

3. THEORY OF OPERATION

3.1 CONSTRUCTION

The HM-3719 monitor consists of three major modules and the CRT.

a. Power supply module : SG2W80 (337-000)

The power supply module supplies the appropriate voltage required by picture tube, video amplifier module, deflection module, etc.

b. Deflection module : FDF300 (237-050)

Deflection module consists of scanning circuit and high voltage circuit for CRT tube biasing.
Scanning is performed by shooting a beam of electrons onto the fluorescent surface of the CRT and deflecting the electrons by changing the current applied to the deflection yoke.
Pictures are composed of lines of scanning spots. The number of lines is refered to as the number of scanning lines.
There are two types of scanning methods, one method scans sequentially and the other employs an interlaced scanning pattern to cover the entire picture.
In interlaced scanning, one vertical scan is called a field and complete scanning by two fields is called a frame.

c. Video amplifier module : FVD300 (237-000)

This module serves to amplify video signals to the

level required by the picture tube.
It also has functions to distribute signals to the synchronizing circuit, DC restore circuit, and adjust brightness.

d. CRT tube

The CRT tube is composed of a tri color phospher dot screen, a shadow mask, and an electron gun that emits three electron beams.

The CRT tube is designed to illuminate phospher dots by applying electrons from the electron gun to the fluorescent screen, and to produce pictures by tracing the movement of these light spots as the electron rays are deflected by the deflection yoke.
The three-beam electron gun has an inline arrangement where the sections of three electron beams are arranged on one straight line horizontally.
The three electron beams emited from the electron gun are deflected and scan the entire fluorescent screen.
The electron beams must first pass through holes in the shadow mask which ensure the beams will strike only their corresponding phosphor colors on the screen.
One set of red, green and blue dots can reproduce any color depending on the amplitude of the signal received.

3.2 CIRCUIT DESCRIPTION

3.2.1 Video amplifier module : FVD300

3.2.1.1 Video Amplifier Circuit

The video amplifier module is composed of three amplifiers, one for red, green and blue channels, respectively. These amplifiers have identical functions. Therefore, the operation of only the amplifier for red-colored channel will be explained below. Each of the amplifiers has the following functions:

- Buffer amplification
- Gain control, preamplification and frequency compensation
- DC restoration
- Background and brightness control
- Level shifting
- Frequency compensation and video drive

a. Buffer amplification (Fig. 3-1)

Video input signal is led through AC coupling with a capacitor C101 to a transistor Q101. The emitter follower fashion of this transistor which is connected to a gain control circuit at the next stage and achieves a high impedance input.

b. Gain control, and frequency compensation (Fig. 3-1)

Transistor Q102 has its collector connected to a gain potentiometer VR101. Output of this potentiometer VR101 controls the base voltage of transistor

Q103. Turning the gain potentiometer VR101 will cause the gain of Video amplifier to be changed. And in this stage, by turning VC101 and VC102, the frequency response is compensated. Thus, signal level and frequency response can be adjusted to get adequate picture luminance and white balance. Finally, the collector of the transistor Q103 is connected to transistor Q104 to change output impedance lower for a DC restoration circuit at the next stage.

c. DC restoration (Fig. 3-1)

During a DC restoration signal (DC RESTORE) in the back porch period is applied from the SYNC circuit (Fig. 3-3) to the analog switch (IC102), a voltage from the video output (R-SENSE) is transfered through IC102 and charged into capacitor C131. A predetermined reference voltage and the charged voltage are compared in the operational amplifier IC101 of which the output voltage controls the bias voltage of a transistor Q105. As a result, the operational amplifier IC101 produces an output voltage to maintain the black level of the video output.
In this manner, the black level of the screen is kept constant.

d. Brightness control (Fig. 3-3)

Brightness control changes the black level of the

screen. This voltage is fed to the operational amplifier IC101 in the DC restoration circuit (Fig. 3-1) where it will be used as a reference voltage.

when the brightness control is maximum. And VR103 controls the white balance tracking when brightness control is changed to minimum condition.

e. Predriver (Fig. 3-1)

Transistors Q105 through Q109 are provided to amplify video signal so as to drive the final amplifying transistors Q111 and Q112. Transistors Q105 and Q106 form together a feedback amplifier of which voltage gain is determined by R119/R118 ratio approximately. Transistor Q107 is used for providing the DC current bias for Q108 and Q109.
Q108 and Q109 reduce the output impedance in order to drive a transistor Q112 at the next stage.

f. Frequency compensation and video drive (Fig. 3-2)

The transistors Q111 and Q112 are the final stage of video amplifier to drive the CRT cathode.
The frequency response of the high voltage video signal is compensated by adjusting coils L101 and L102.

3.2.1.2 Sync Circuit (Fig. 3-3)

The Synchronization (sync) circuit is composed of a sync signal separator and a sync signal processor.

a. Sync signal separator

The sync signal separator comprises an input buffer amplifier (Q401, Q402), sync signal separator (IC401) and a bias voltage control circuit (Q403, IC401). Composite signal (GREEN) and external sync (EXT SYNC) signals are fed through the input buffer amplifier Q401, Q402 to the signal detector IC401.

The bias voltage control circuit (Q403, IC401) maintains the signal level so that the negative peak level of the signal is always just below the threshold of the sync signal separator IC401. By the means described above, the sync signal is detected from the composite image signal with the signal detector IC401.

By operating VR401 to adjust the threshold with respect to the sync signal level, said separation or detection of sync signal is securely done.

b. Sync signal processor

The sync signal processor consists of a vertical sync control circuit, blanking signal generator circuit, horizontal sync control circuit, and a DC restoration signal generator.

The vertical sync control circuit separates a vertical sync signal (V. SYNC) from the H & V mixed sync signal with a monostable multivibrator (IC402) and flip-flop (IC405).

The output of the flip-flop (IC405) drives a monostable multivibrator (IC404) to provide a vertical blanking signal.

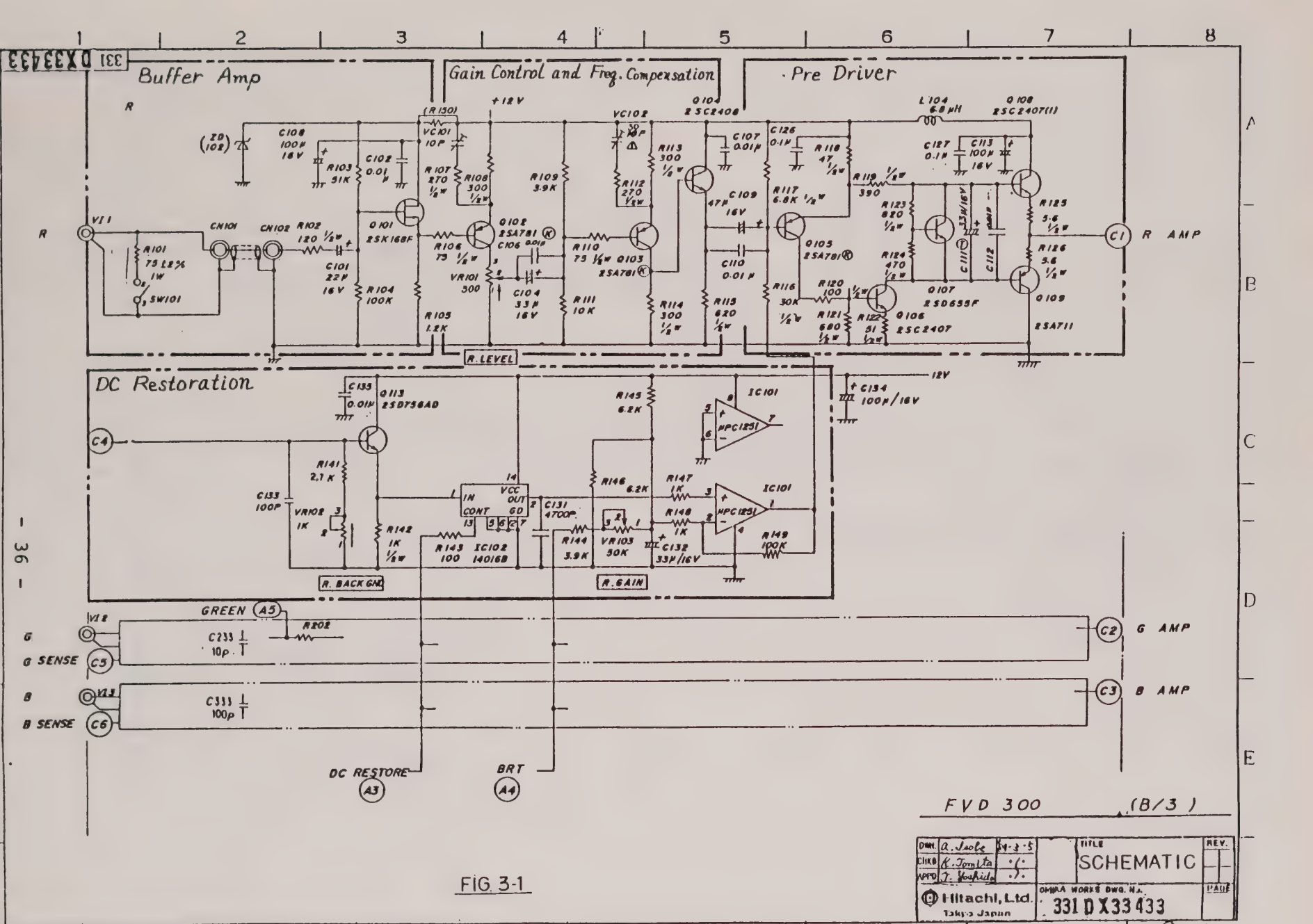
Vertical Blanking Time is adjusted by turning the potentiometer VR403.

The horizontal sync control circuit comprises an inverter (IC407), flip-flop (IC405) and two monostable multivibrators (IC403) which remove the overtoned sync signal such as equalization pulse in RS-170 waveforms, and normalizes the pulse width so that the picture position can be calibrated by controlling the its pulse width with VR402.

H and V. Sync and V blanking signal are fed to an AFC circuit of deflection module.

The DC restoration signal generator circuit is formed by two monostable multivibrators (IC402, IC404) to produce a DC restoration signal (DC RESTORE). One of them (IC402) generates a pulse in the horizontal back porch period from the falling edge of the H. Sync signal. This signal is fed to the DC restration circuit in the video amplifier circuit for gating the feed back voltage from the video output to maintain black level.

When the sync signal is not applied, the other IC404 detects such a condition and sets the DC Restoration signal to gate on so that black level control is maintained.



FVD 300 (B/3)

FIG. 3-1

DWN	A. Isobe	84-3-5	TITLE SCHEMATIC	REV.
CHKD	K. Tomita	"		
APPD	T. Yoshida	"		
Hitachi, Ltd. Tokyo Japan			OMURA WORKS DWG. NO. 331 D X33433	SHEET

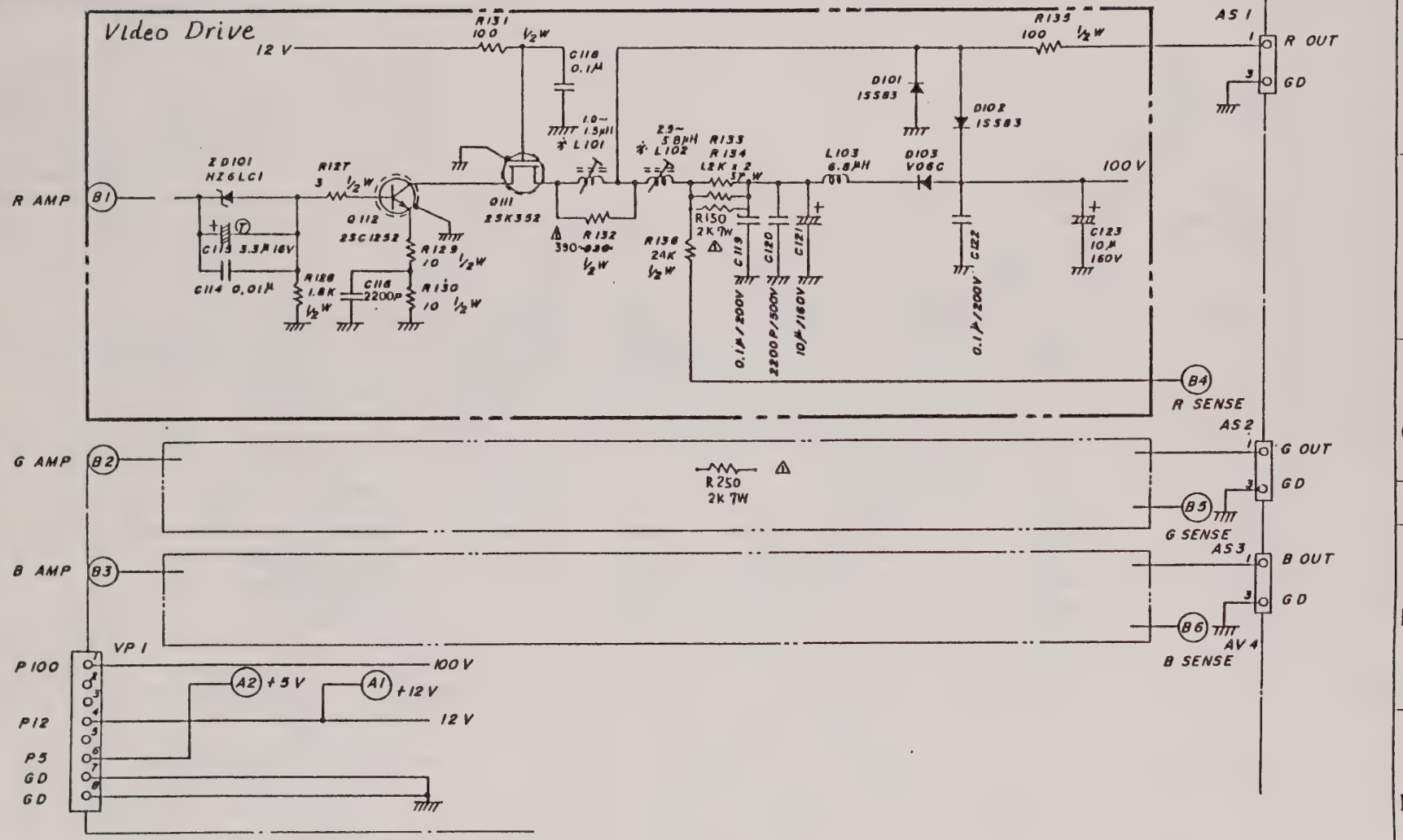


FIG. 3-2

FVD 300 (C/3)

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CHKD	K. Tomita	"	SCHEMATIC	
APPD	T. Yoshida	"		PAGE
Hitachi, Ltd. Tokyo Japan			OMIYA WORKS DWG. NO. 331 DX33434	

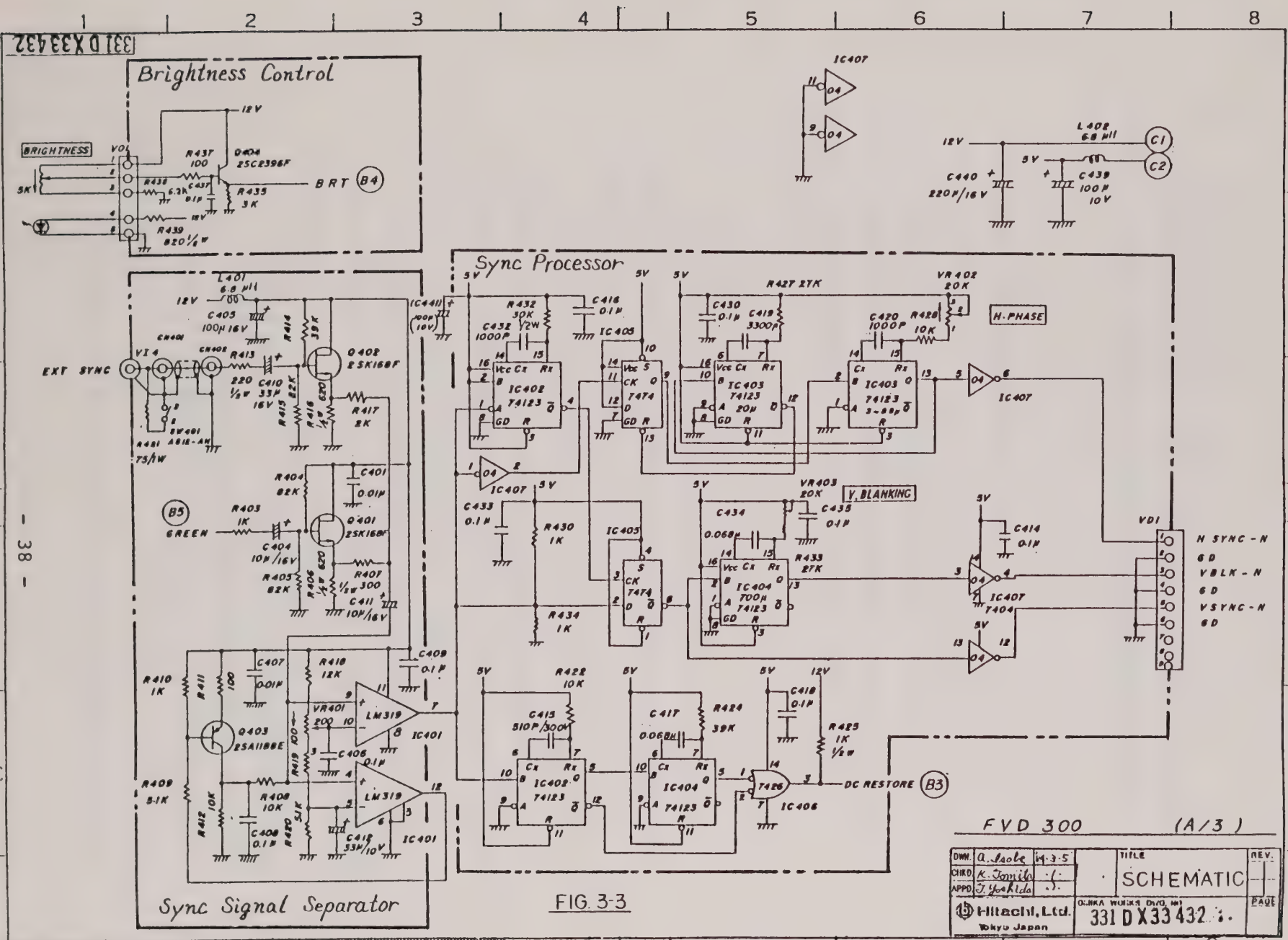


FIG. 3-3

FVD 300 (A/3)

DWN	A. Isobe	4-3-5	TITLE	REV.
CHKD	K. Tomita		SCHEMATIC	
APPD	T. Yoshida			PAGE
Hitachi, Ltd. Tokyo Japan			OHMA WORKS DVD, MI 331 DX33432	

3.2.2 Deflection Module : FDF300

The deflection module includes the horizontal scanning circuit, vertical scanning circuit and high voltage power supply.

3.2.2.1 Horizontal Scanning Circuit

The horizontal scanning circuit supplys deflection yoke saw tooth current for horizontal scanning of the electron beams, and has an AFC (Automatic Frequency Control) circuit for adjusting the retracing phase of the horizontal scanning into the horizontal blanking period.

a) Horizontal AFC circuit (Fig. 3-4)

Horizontal AFC is achieved by PLL (Phase Locked Loop) IC (IC2) and operates to adjust the retracing phase to the horizontal blanking period.

Horizontal sync pulse (H-SYNC), and Fly-Back Pulse (FBP) produced from detecting the retrace phase of horizontal scanning current are fed to the inputs of phase comparator portion in PLL IC (IC2) respectively.

The output signal from the phase comparator is fed to R8 and C6 in the portion of the VCO (Voltage Controlled Oscillator) of IC2 through Low pass filter R7 and C4. In this configuration, when there exists a phase deviation between the H-Sync signal and FBP signal, the phase comparator varies its oscillation frequency to adjust this phase relation.

AFC operation requires, the free running frequency

of the VCO to have been previously adjusted near the horizontal scanning frequency with VR2 (H.HOLD VR)

In this way, an output signal from the VCO of IC2, (H. DRIVE pulse) reflects evidence that the phase of horizontal scanning retrace matches with the blanking period of the input signal driving horizontal drive transistors Q6, Q7 through T1.

b) Horizontal drive circuit (Fig. 3-5)

In the first half of the scanning period, the horizontal scanning current (saw tooth current) flows in a path with D10, D26, T3, HDY (Deflection Yoke), L5, C31 and C32.

In the second half of the scanning period, its current changes the direction and flows in a path with C31, C32, L5, HDY, T3, Q6, and Q7.

In the period of retrace, Q6, Q7 turns to the OFF state, and the current flows in the path with C35, C36, T3, HDY, L5, C31, C32 and changes its direction in the middle of period, in accordance with the LC resonance of C35, C36 and HDY. L5 is a non-linear variable inductance for the compensation of linearity.

c) Picture width control and side pincushion compensation circuit

A picture width control and side pincushion compensation is achieved by changing the horizontal drive circuit voltage.

The triangle wave form on R67 in the vertical scanning circuit is integrated with operational amplifier IC3 through C64, and is transformed to a parabolic voltage waveform for side pincushion compensation.
The reference voltage for picture width control and this parabolic waveform are amplified with IC3 and are fed to transistor Q15 for controlling the horizontal drive circuit through Q16.
The picture width is controlled with VR13 and side pincushion is corrected with VR12.

d) Horizontal centering

The horizontal center adjustment of the raster is performed by controlling the D.C bias current for the horizontal deflection yoke with VR6.

3.2.2.2 Vertical deflection circuit (Fig. 3-6)

The vertical deflection circuit comprises a vertical oscillator for generating a saw tooth voltage synchronized to the vertical sync (V-SYNC) signal and the vertical driver for supplying proportional current to deflection yoke.

a) Vertical oscillator

The vertical oscillator consists of a trigger circuit for detecting the V-SYNC pulse from the video amplifier module, a vertical oscillator circuit for generating the saw tooth voltage starting at the rising edge of V-SYNC pulse, and an operational amplifier circuit for

controlling the vertical driver.

The slew rate of the saw tooth voltage is determined with C51, and R55, VR8 controls both the free running frequency of vertical oscillator when V-SYNC pulse is lost, and the triggering sensitivity for detecting the V-SYNC signal.

b) Vertical driver

The saw tooth current for vertical scanning flows in the path of Q11, VDY Deflection yoke, C54, R67 in the first half of scanning period, and in the second half of scanning period, the current changes its direction in reverse and flows in the path with R67, C54, VDY, Q10.

This current is transformed to voltage across R67, and this voltage is fed back to operational amplifier IC2 through VR9 and controlled to be the same waveform as those of the output signal from the vertical oscillator.

c) Height and vertical linearity correction

The picture height and the vertical linearity is functionally controlled by changing the feedback gain from the vertical driver to the vertical oscillator. The picture height control is performed with VR9, the vertical linearity is controlled with VR14.

3.2.2.3 Blanking Control (Fig. 3-5)

To blank the horizontal and vertical raster while they are in the retrace phase, H-SYNC and V-BLANK signal from the sync processor in the video amp. module are mixed by IC1, this signal is fed to Q2, which controls the 1st grid (VG1) of the CRT tube and cuts all R.G.B beams off when this signal is applied.

3.2.2.4 High Voltage Power Supplies (Fig. 3-5)

a. CRT anode voltage (+27 kV power supply)

The +27 kV power supply is composed of the switching transistors Q6, Q7, that are used for driving the horizontal deflection coil, fly back transformer T2 and the high voltage stabilizing circuit.

The energy stored on the primary side of T2 during Q6/Q7 turning ON is released as high voltage to the secondary side of T2 while Q6, Q7 is OFF (horizontal blanking period).

This high voltage is then rectified to 27 kV and the voltage is supplied to the anode of CRT. This voltage is fed back to a stabilizing circuit Q5, Q3 so that a constant voltage will be obtained. This voltage is adjusted with VR3. VR3 is locked and improper adjustment may result in excessive X-RAY radiation.

b. CRT screen grid voltage

The constant +680 V power supply is obtained through the varistor SGA1 by rectifying the high voltage pulse of approximately 1,000 V which is generated on transistors Q6, Q7. This voltage is divided by variable resistor VR1 on the socket board FCS200 and supplied to the CRT screen grid G2. Other biasing voltage are also delivered from the fly back transformer T2 i.e. 6.3 V for HEATER, 20 V for amplifier etc.

c. Focus voltage (+8000 V power source)

The high voltage (27 kV) is divided by the focus block and supplied to the focus grid G3 of the CRT.

d. High voltage shutdown circuit

The high voltage shutdown circuit detects any abnormal increase in the anode voltage of the CRT. When the anode voltage increases abnormally, the voltage across the capacitor C18 rises proportionary and pin 8 of IC3 turns "High". IC2 is inactivated by the "High" state of IC3 and the high voltage stops.
This condition is maintained until the operator turns the main power source off.
The shutdown threshold voltage is controlled with VR4. VR4 is also locked and improper adjustment may result in excessive X-RAY radiation.

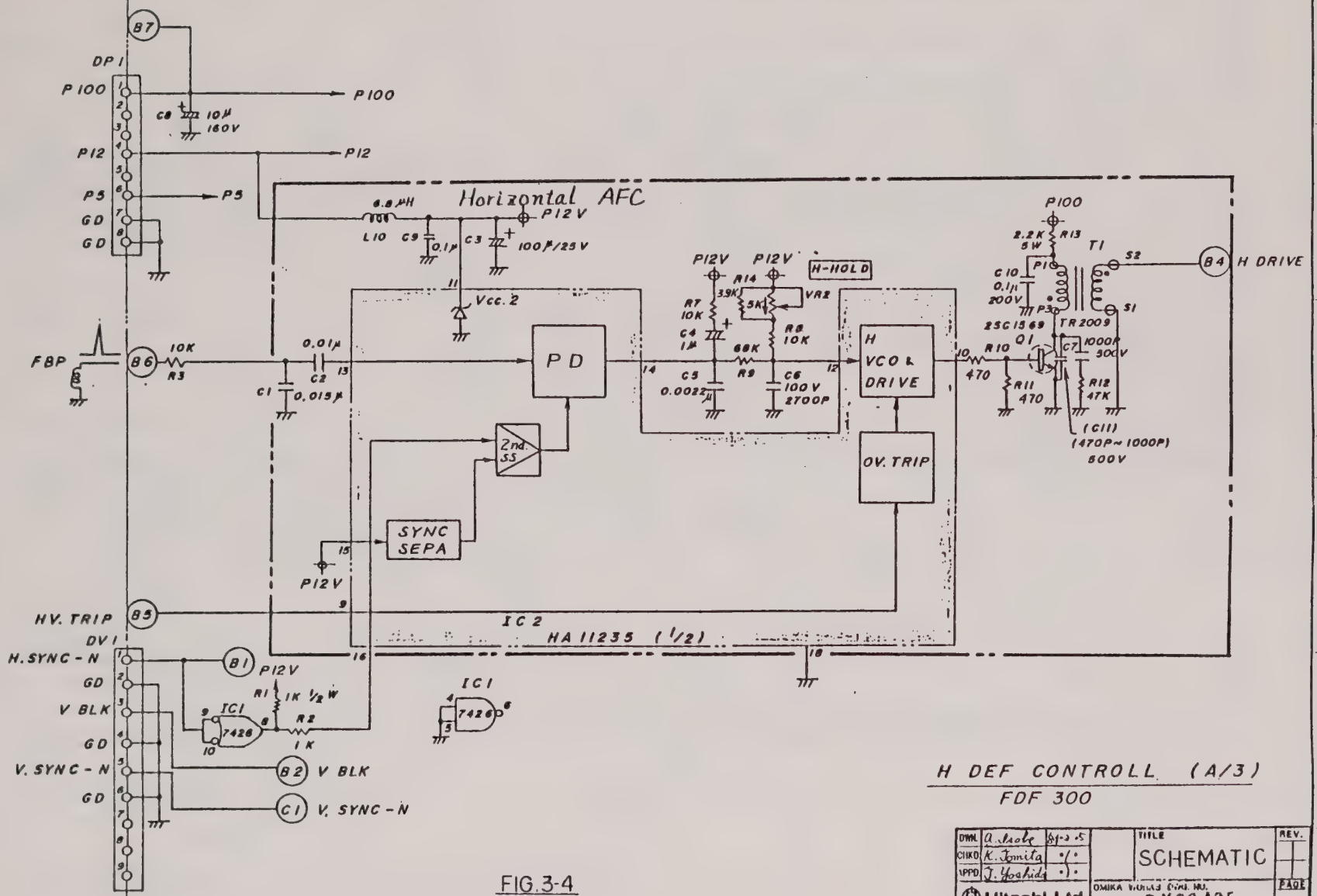


FIG.3-4

H DEF CONTROLL (A/3)

FDF 300

DWN	A. Ikebe	84-2-5	TITLE: SCHEMATIC
CHKD	K. Tomita	·/·	REV.
APPD	T. Yoshida	·/·	PAGE
Hitachi, Ltd. Tokyo Japan			OMIKA WORKS DWG. NO. 331 DX33435

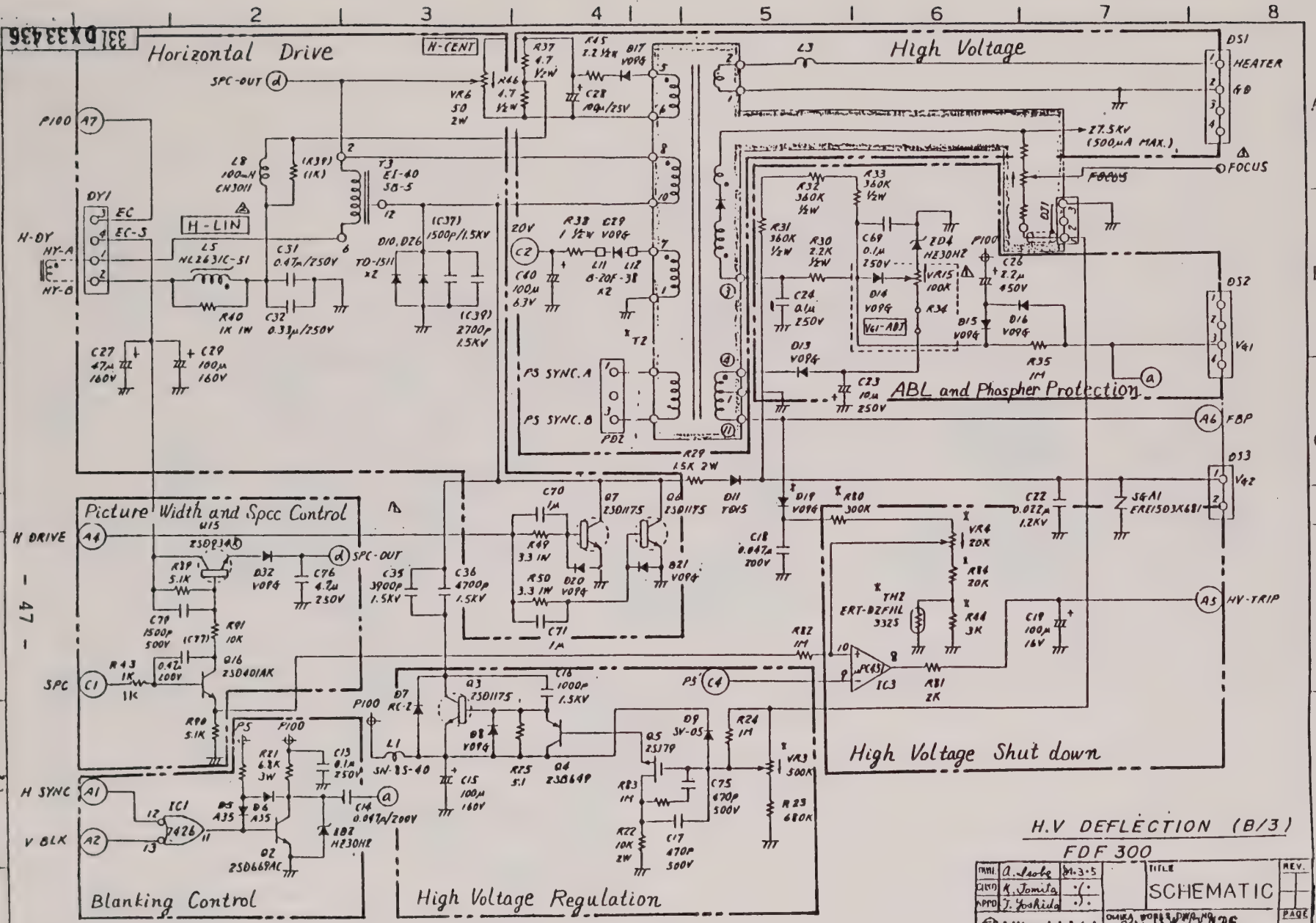
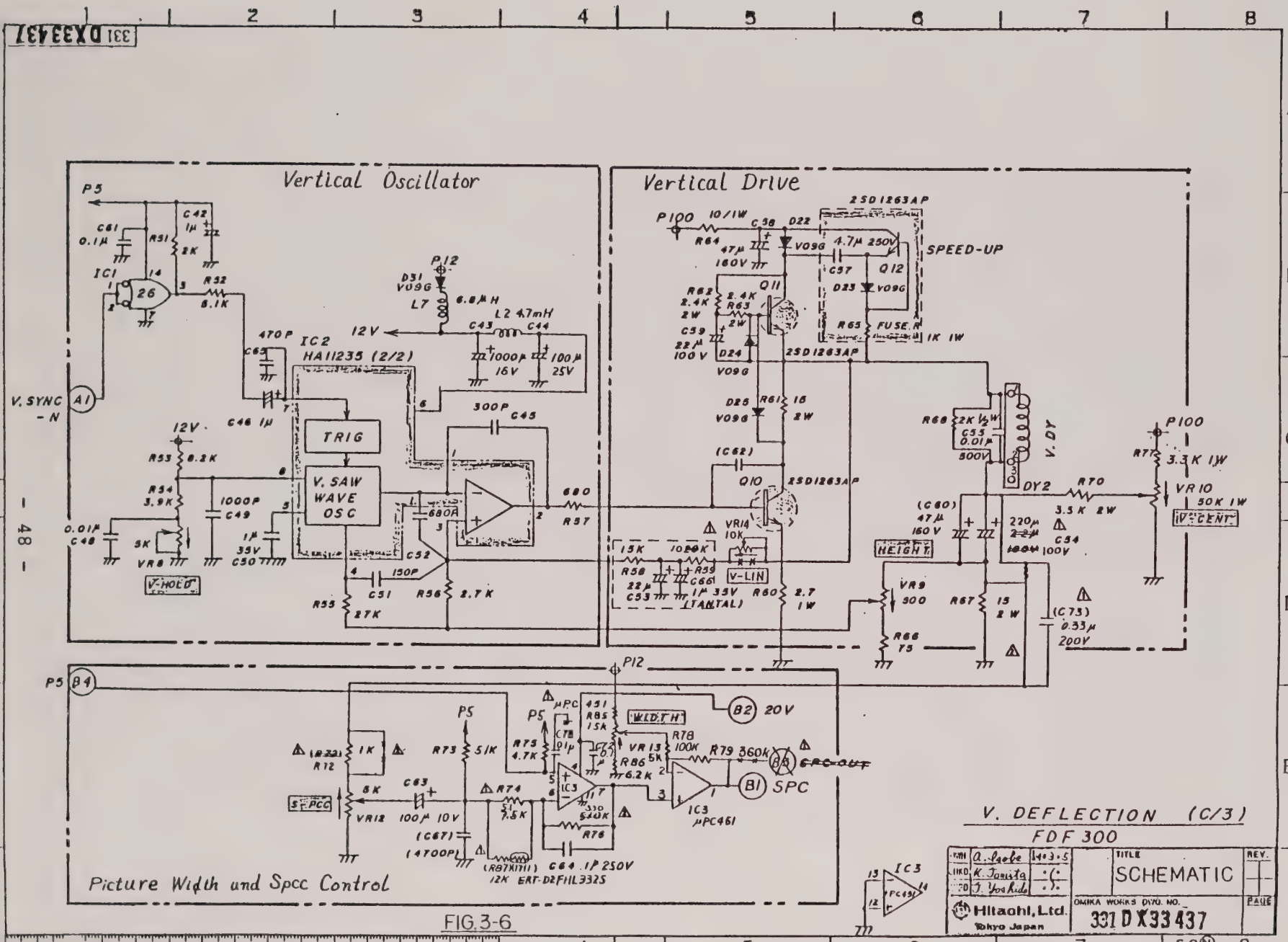

Horizontal Drive
H-CENT
SPC-OUT
H-LIN
H-DY
P100
DY1
EC
EC-S
HY-A
HY-B
L8
100-N
CN3011
(R39)
(1K)
T3
EI-40
SB-5
L5
NL2631C-51
C31
0.47μ/250V
C32
0.33μ/250V
R40
1K 1W
C27
47μ
160V
C29
100μ
160V
(C37)
1500P/1.5KV
D10, D26
TD-1511
x2
(C39)
2700P
1.5KV
R37
4.7
½W
R46
4.7
½W
VR6
50
2W
R45
2.2 ½W
B17
V09G
C28
100μ/25V
20V
C2
C60
100μ
6.3V
R38
1
½W
C29
V09G
L11
L12
B-20F-38
x2
T2
FS SYNC. A
FS SYNC. B
PD2
R29
1.5K 2W
D11
V09S
L3
High Voltage
DS1
HEATER
6.3
27.5KV
(500μA MAX.)
FOCUS
R32
360K
½W
R33
360K
½W
R31
360K
½W
R30
2.2K
½W
C69
0.1μ
250V
ZD4
HE30HZ
P100
VR15
100K
R34
C24
0.1μ
250V
D14
V09G
Vg1-ABL
D15
V09G
D16
V09G
R35
1M
C23
10μ
250V
C26
2.2μ
450V
DS2
Vg1
ABL and Phospher Protection
A6
FBP
DS3
Vg2
D13
V09G
C70
1μ
Q7
2SD1175
Q8
2SD1175
R49
3.3 1W
R50
3.3 1W
D20
V09G
B21
V09G
C71
1μ
D19
V09G
R10
300K
C18
0.047μ
200V
VR4
20K
R14
20K
C22
0.022μ
1.2KV
SG-A1
ERE150X681
A5
HV-TRIP
THZ
ERT-DZF11L
332S
R44
3K
C19
100μ
16V
R42
1M
IC3
μPC43
R41
2K
Picture Width and Spcc Control
H DRIVE
A4
U15
2SD934A
R39
5.1K
D32
V09G
C76
4.7μ
250V
C35
3900P
1.5KV
C36
4700P
1.5KV
C79
1500P
500V
(C77)
R91
10K
R43
1K
0.47
200V
Q16
2SD401AK
SPC
C1
11K
R90
5.1K
P5
P100
R21
6.3K
3W
C13
0.1μ
250V
IC1
μPC426
D5
A35
D6
A35
B22
H230HZ
Q2
2SD669AC
H SYNC
A1
V BLK
A2
C14
0.047μ/200V
a
D7
RC-2
L1
SW-35-40
Q3
2SD1175
C16
1000P
1.5KV
D8
V09G
R25
5.1
Q4
2SB649
C15
100μ
160V
P5
C4
D9
SV-05
Q5
2SJ79
R24
1M
R23
680K
VR3
500K
R23
1M
R22
10K
2W
C17
470P
500V
C75
470P
500V
High Voltage Regulation
High Voltage Shut down
H.V DEFLECTION (B/3)
FDF 300
DRN'D A. Isobe M.3.5
CHK'D K. Tomita
APP'D T. Yoshida
Hitachi, Ltd.
Tokyo Japan
TITLE
SCHEMATIC
REV.
PAGE
OMRA WORK'S DWG. NO.
331DX33436

FIG.3-5



V. DEFLECTION (C/3)

FDF 300

DRN	A. Isobe	44.3.5	TITLE SCHEMATIC	REV.
DES	K. Tanaka			
APD	T. Yoshida			PAGE
Hitachi, Ltd. Tokyo Japan			OMIKA WORKS DWG. NO. 331 DX33437	

FIG.3-6

3.2.3 Low Voltage Power Supply Module : SG2W80

3.2.3.1 Block diagram

The general operation of this low voltage power supply will be explained below with reference to Fig. 3-7 "Overall Block Diagram".

Input voltage (100-120 V AC or 200-240 V AC) supplied through the filter is rectified and filtered by diode D1 and input capacitors C4 and C5 to provide a DC coarse-rectified voltage which will be switched by TRS Q1 and delivered as P100 (+100 V), P12 (+12 V) and P5 (+5 V).

The switching frequency is so controlled as to be synchronous with the horizontal deflection signal. For preventing excessive rush current from flowing at the time of supplying an input, an rush limit circuit is provided to control the current.

3.2.3.2 Switching of input voltage

With this power supply, when an input of 120 V AC is supplied, the connector PP3 should be connected to PP3-1, the input is voltage-doubled by D1, C4 and C5 to produce a DC coarse-rectified voltage of about 250 V. When an input of 240 V AC is supplied, the connector PP3 should be connected to PP3-2, the input is full-wave rectified by D1, C4 and C5 to provide a DC coarse-rectified voltage of approximately 250 V.

3.2.3.3 P100 (+100 V) constant voltage circuit (Fig. 3-8)

The DC coarse-rectified voltage is switched by a switching regulator of a ringing type comprising a main TRS Q1, starting resistors R5 and R6, primary windings N1 and N_B of transformer T1, and a time constant circuit (C6, C7, R8, R9). The on/off ratio of the main TRS Q1 can be controlled by Q5 and the oscillation frequency of Q1 is controlled for synchronization by horizontal sync signal.

The energy accumualted while Q1 is in the ON state is flyed back, when Q1 is turned off, and delivered to the secondary side, rectified and filtered by D11, C24 and C25 to provide a DC voltage of +100 V. At the same time, P100 is compared with its reference voltage in the output detection circuit, and the error signal is transmitted through the photocoupler PC1 to the primary-side control circuit. This feedback signal is used to control Q1. By controlling I_B of the main

TRS Q1, the ON time of Q1 is controlled to stabilize P100.

As protective features, an overvoltage and overcurrent detection circuits are provided. When the output voltage reaches 130 to 150 V, a voltage E_B proportional with the P100 voltage develops in the winding N_B of the transformer T1, is detected by Zener diode ZD3.

When ZD3 conducts, Q3 and Q4 turn on, and then Q8 turns on, so that the base voltage of the main TRS Q1 is dropped to "L" level. Thus, the switching of Q1 is suppressed to stop any further output. Transistors Q3 and Q4 form together a latch circuit; so once the output is stopped, it will not be restarted until the power switch is turned off. For releasing the tripping, turn off the power switch.

After converted to primary-side current, load current is converted to voltage by R10. When the load current is 1.3 to 1.7 A, the overcurrent detection circuit is activated. When an overcurrent is detected, Q2 turns on to stop output in quite the same manner as in case of the overvoltage detection. For releasing of tripping, similarly turn off the power switch.

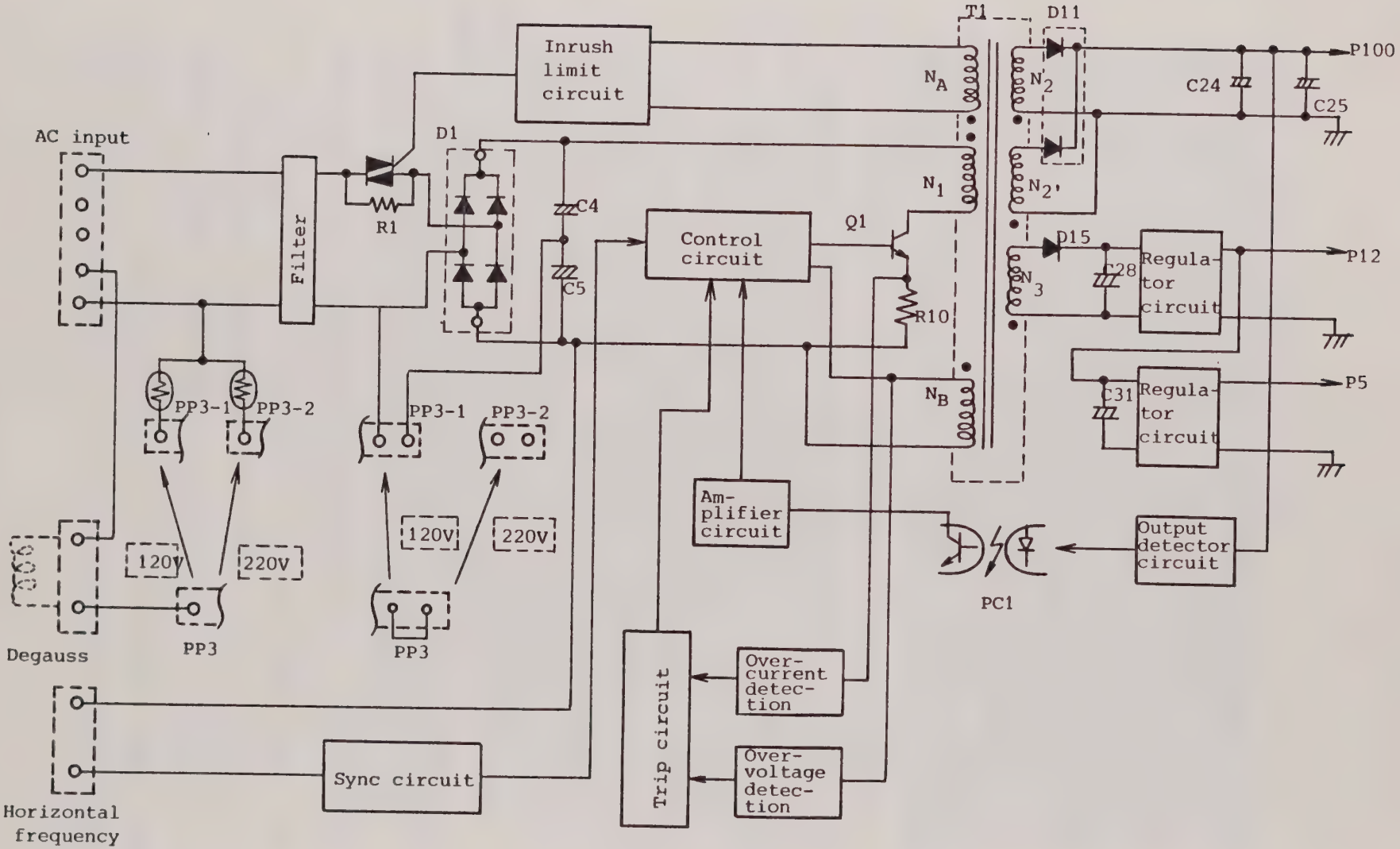


Fig. 3-7 Overall Block Diagram

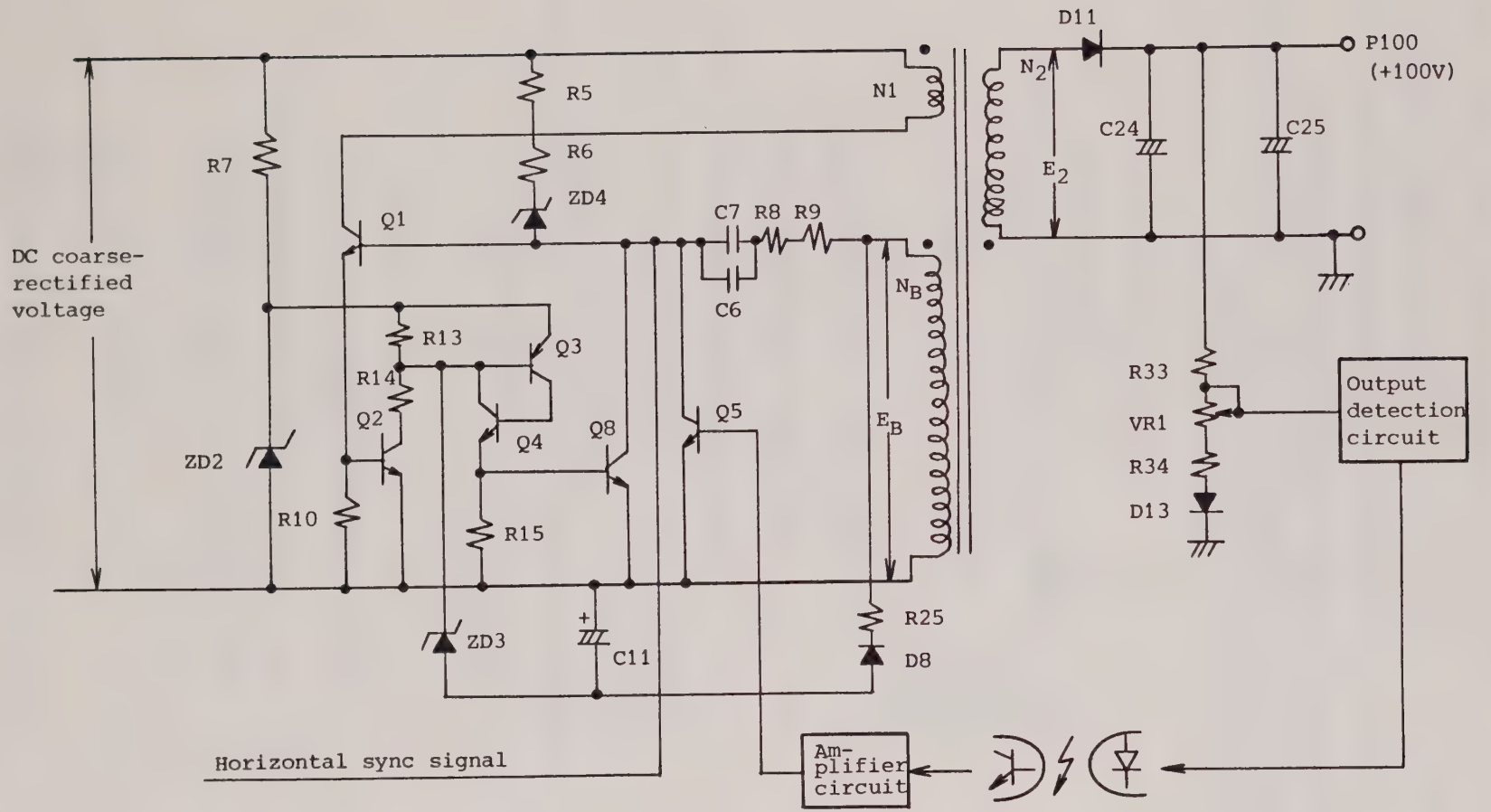


Fig. 3-8 P100 Constant Voltage Circuit

3.2.3.4 P12 (+12 V) voltage regulator circuit (Fig. 3-9)

After a voltage across the winding N_3 of T1 is rectified and filtered by D15 and C28, it is supplied to a 12 V stabilizer IC (IC11) to provide a regulated DC voltage.

Since an overcurrent protective circuit is incorporated in IC11, current is limited to about 0.3 A.

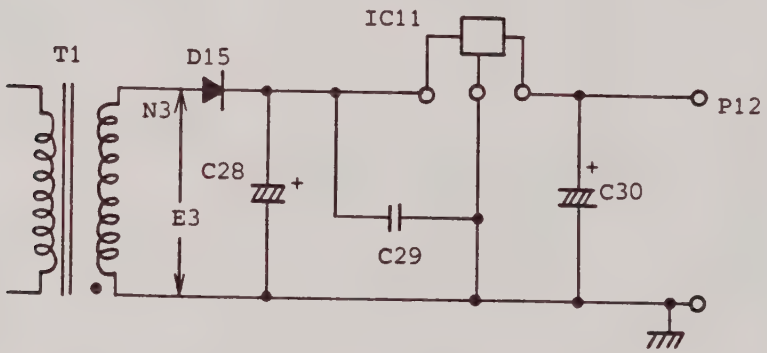


Fig. 3-9 P12 Voltage Regulator Circuit

3.2.3.5 P5 (+5 V) voltage regulator circuit (Fig. 3-10)

A DC voltage of +12 V regulated through the +12 V circuit is converted to a 5 V DC regulated voltage by IC12

Since an overcurrent protective circuit is incorporated in IC12, current is limited to about 0.4 A.

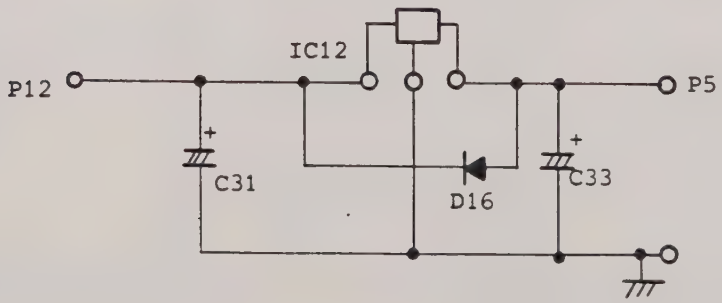


Fig. 3-10 P5 Voltage Regulator Circuit

4. ADJUSTMENT AND TEST

4.1 TEST EQUIPMENT AND SPECIAL TOOLS

The following test equipment and special tools, or equivalent substitutions are recommended to maintain the monitor :

a. Volt-ohm-Ammeter :
   FLUKE 8021B

b. High Voltage Probe 40 kV :
   FLUKE 80K-40

c. Oscilloscope :
   SONY TEKTRONIX Type 475A

d. White balance adjuster :
   Minolta Color Analyzer II

e. TV signal generator : Vii 1208A

f. Magnifying glass (×10)

g. Degaussing Coil :
   G.C. Electronics catalog No. 9317

h. Hex Tuning Tool :
   G.C. Electronics catalog No. 8284

i. Alignment Screwdriver :
   G.C. Electronics catalog No. 5009

CAUTION

USE A NON-METALLIC TOOL TO MAKE ALL ADJUSTMENTS.

4.2 DEGAUSSING

Degaussing will be required when poor color purity appears on the screen. This monitor is equipped with a built-in degaussing coil and an internal shield. However use of an external hand-held degaussing coil may be necessary for other parts like the cabinet, which may have been magnetized during handling and transportation.

a. Built-in degaussing

By depressing the DEGAUSS switch, the CRT and its internal shield will be manually degaussed. Keep the switch depressed until the color distortion disappears.

b. External degaussing

Turn on the hand-held degaussing coil at a distance of 3 feed (1 m) from the screen. Move it to within about 4 inches (10 cm) of the top and side of the screen. Make a slow circular movement a few times. Then move the coil gradually away from the screen and turn off the coil. Do not turn off the coil within 3 ft. (1 m) from the display.

This procedure is highly recommended at the time of installation.

4.3 BRIGHTNESS

BRIGHTNESS control increases or decreases the DC level of the red, green and blue signals (brightness of the raster of red, green and blue). By turning clockwise, the luminance will be increased.

4.4 ADJUSTMENT

4.4.1 Synchronize Adjustment

Adjusting Potentiometer

H. HOLD : FDF300 VR2

V. HOLD : FDF300 VR8

SYNC LEVEL : FVD300 VR401

Condition

Display Pattern : Cross-Hatch

Adjustment Procedure

(1) Adjust H. HOLD VR gradually so that the vertical lines of cross-hatch pattern becomes stable.

(2) Adjust V. HOLD VR gradually so that pattern of cross-hatch becomes stable.

(3) Adjust H. HOLD VR gradually again to hold the synchronization in the middle of range.

Note: When the picture is not stable in spite of adjustments as per steps (1) through (3), adjust SYNC LEVEL VR gradually so that the picture becomes stable.

4.4.2 Adjustment of Horizontal Screen Location

Adjusting Potentiometer

H. CENTER : FDF300 VR6

H. PHASE : FVD300 VR402

H. HOLD : FDF300 VR2

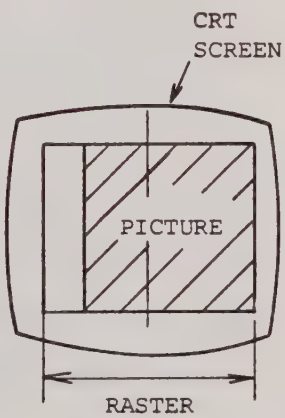
Condition

Display Pattern : Full Size Picture

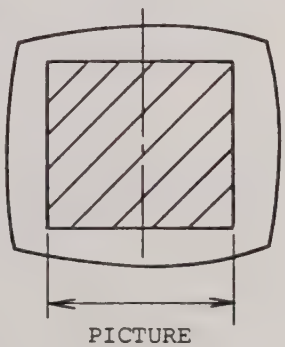
Brightness : Max.

Adjustment Procedure

(1) Set H. PHASE VR to min value, to measure the horizontal range of raster scan. The boundaries of raster scan are shown by bright vertical lines on left and right sides.
Adjust H. CENTER VR so that the center of the raster is centered within the CRT screen.



(2) Adjust H. PHASE VR from min to max value gradually so that the center of the picture aligns with the center of raster scan.
When the value of the H. PHASE VR is changed, horizontal blanking time will vary accordingly.
When, H. PHASE VR is varied to its max value, display width will be shortened. But during this operation, range



of raster scan is unchanged.

(3) When the center of picture can not be set by the operations of (1), (2), that is, the picture is erased by blanking, H. HOLD VR should be reset in mid range of synchronization.
Adjust H. HOLD VR so that the picture may be set in the center.

4.4.3 Adjustment of Vertical Screen Location

Adjusting Potentiometer

V. CENTER : FDF300 VR10

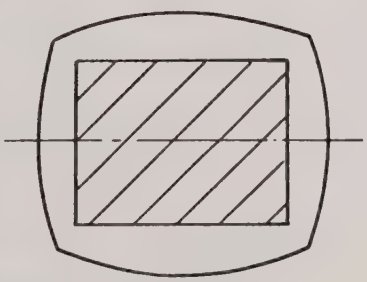
V. BLANKING : FVD300 VR403

Condition

Display Pattern : Full Size Picture

Adjustment Procedure

(1) Adjust V. CENTER VR so that the center of picture aligns with that of the CRT screen.



(2) Adjust V. BLAKING VR for masking of the vertical retrace and matching of vertical blanking of input signal.
Check top of the picture during adjustment.

4.4.4 Adjustment of Picture Size

Adjusting Potentiometer

WIDTH : FDF300 VR13

HEIGHT : FDF300 VR9

SPCC : FDF300 VR12

H. LINEARITY : FDF300 L5

V. LINEARITY : FDF300 VR14

Condition

Display pattern : Full Size Cross-Hatch

Adjustment Procedure

(1) Set V. LINEARITY VR at Table 4-1. (NOTE 1)

Table 4-1

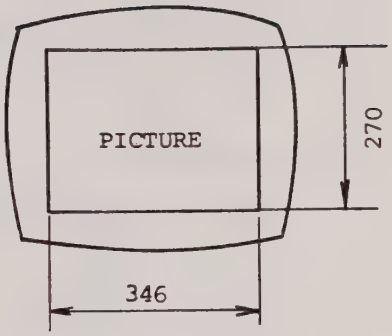
VERTICAL FREQUENCY	SETTING POSITION OF VR14	
58 - 66 Hz	RIGHTWISE DIRECTION	RIGHT
66 - 74 Hz	INTERMEDIATE	CENTER
74 - 82 Hz	LEFTWISE DIRECTION	LEFT

(NOTE 1)

Adjust the VR14 as slowly as possible.
Because of the slow response of VR14, display width and height become temporaly unstable if it is adjusted quickly. Do not touch the VR14 after finishing adjustment.

(2) Adjust WIDTH VR so that horizontal picture width may be 346 mm.

(3) Adjust HEIGHT VR so that vertical picture height may be 270 mm.



(4) Adjust SPCC VR so that vertical lines in both of right and left sides are straight.

(5) Adjust H. LINEARITY COIL so that horizontal spans of cross-hatches are equal. (NOTE 2)

(NOTE 2)

When linearity is adjusted, adjustment of above (1), (2) may be required again due to changes of picture size.

4.4.5 Brightness and White Balance Adjustment

Adjusting Potentiometer

G2 BIAS	:	FCS200 VR1
G1 BIAS	:	FDF300 VR15
R.G.B. BACK GROUND	:	FVD300 VR102(R) VR202(G) VR302(B)
R.G.B. GAIN	:	FVD300 VR103(R) VR203(G) VR303(B)
R.G.B. LEVEL	:	FDV300 VR101(R) VR201(G) VR301(B)

Condition

Display Pattern	:	Full size white
Warm Up Time	:	More than 30 minutes

Adjustment Procedure (NOTE 1)

(1) Set G1 BIAS VR to max value.

(2) Set R.G.B. BACK GROUND VR & LEVEL VR to min value, R.G.B. GAIN VR to max value, and REMOTE PANEL BRIGHTNESS VR to max value.
Adjust G2 BIAS VR so that rester brightness is minimum (just before erased).

(3) If the raster can't be adjusted by the (2) procedure, control G1 BIAS VR (VR15 on FDF300) so that raster may be displayed at minimum brightness output.

(4) Adjust R.G.B. BACK GROUND VR from min to value so that raster becomes gray.
But in this case, keep such BACK GROUND VR to min value as corresponds to the color which is displayed brightest during the (1) procedure.

(5) Adjust R.G.B. LEVEL VR from min to value so that picture may be white of max luminance.

this case, keep GAIN VR to max value as corresponds

(6) Control REMOTE PANEL BRIGHTNESS VR from max to min. value so that picture may be about to be erased. Then control R.G.B. GAIN VR from max to value where the picture will be white. But in this case, keep GAIN VR to max. value as corresponds to the color which is displayed darkest (the first color to be erased when brightness is weakened) with condition that R.G.B. GAIN VR are max value.

(NOTE 1)

It is recommended that VR will be kept as adjusted from the factory except VR's relevant to (3) procedure, which may be required to be adjusted by user.

4.4.6 Focusing

Control and set FOCUS VR so that the best focus may be obtained for entire screen.

4.4.7 High Voltage Adjustment

Notice: When X-Ray Critical Component is changed, HV ADJ and HV TRIP readjustment should be performed. After readjustment, HV ADJ VR and HV TRIP VR should be locked using Epoxy Adhesive for continued X-radiation protection.

Adjusting Potentiometer

HV ADJ : FDF300 VR3

HV TRIP : FDF300 VR4

Conditions

Display Pattern : Black field

Brightness : Minimum

Adjustment Procedure

(1) Adjust HV TRIP VR so that the anode voltage may be shut off at 33.5 KV ± 0.5 kV when the anode voltage is gradually raised by HV ADJ VR.

(2) Adjust HV ADJ VR so that the anode voltage may be 27 kV ± 0.1 kV.

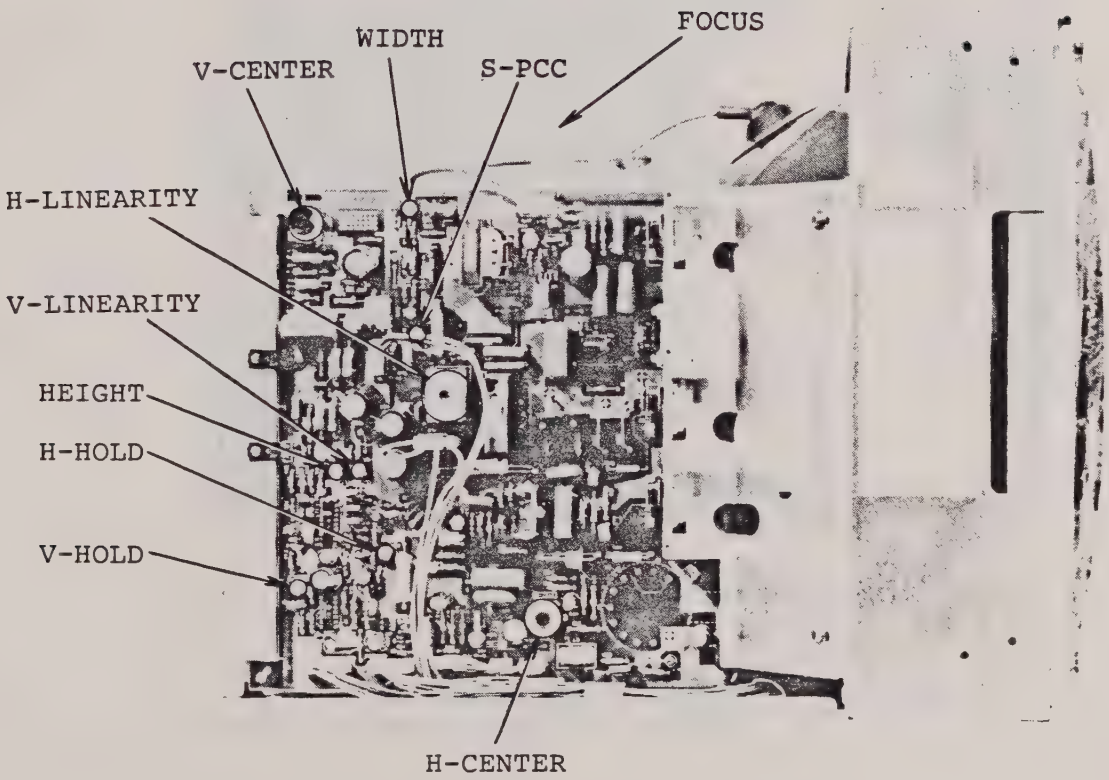


Fig. 4-1 LOCATION OF ADJUSTMENTS
(Deflection module : FDF300)

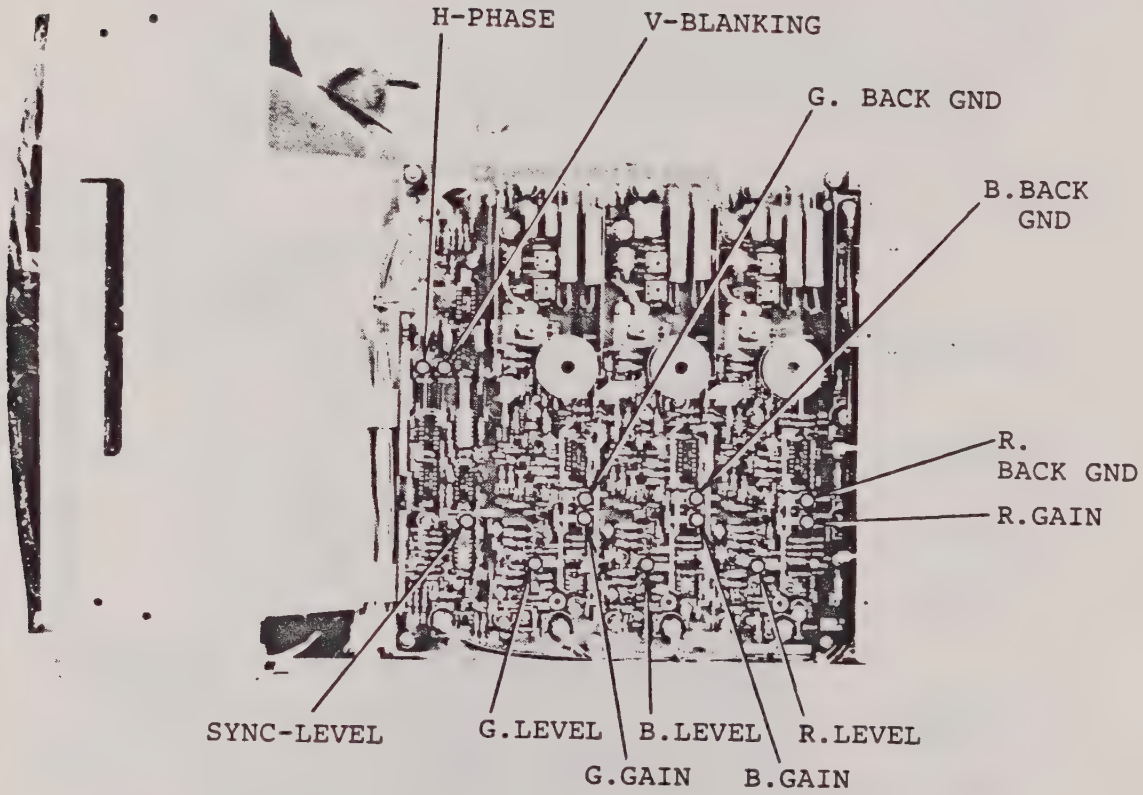


Fig.4-2 LOCATION OF ADJUSTMENT
(Video Amplifier module : FVD300)

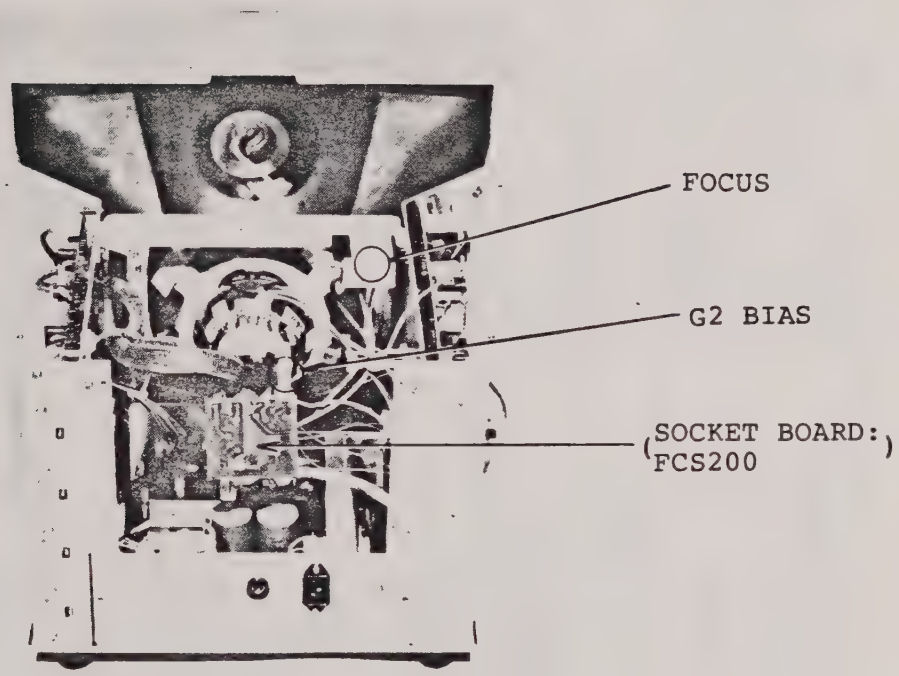


Fig. 4-3 LOCATION OF ADJUSTMENT
(Top view)

POWER SUPPLY BOARD (1/1)

NO.	DESIGNATION			FUNCTIONAL DESCRIPTION	POLARITY (CCW) (CW) MIN. MAX.	REMARKS ADJ. PROCEDURE
	PCB	DEVICE NO.	SYMBOL NAME			
	FPS300	VR 1	(P100)	P100 OUTPUT VOLTAGE ADJUSTMENT	HIGHER VOLTAGE	100V +1% Should not be changed
	|	PP 3	AC INPUT RANGE	AC INPUT RANGE SELECTION		
	|	PP3-1	AC 100/120V	CONNECT PP3 TO PP3-1 FOR AC 100V∿120V		
	FPS300	PP3-2	AC 200/240V	CONNECT PP3 TO PP3-2 FOR AC 200V∿240V		

VIDEO BOARD (1/2)

NO.	DESIGNATION			FUNCTIONAL DESCRIPTION	POLARITY (CCW) (CW) MIN. MAX.	REMARKS ADJ. PROCEDURE
	PCB	DEVICE NO.	SYMBOL NAME			
	FVD300	VR403	V.BLANKING	VERTICAL BLANKING CONTROL	INCREASE BLANKING AREA	
		VR402	H.PHASE	HORIZONTAL CENTERING OF ACTIVE DISPLAY AREA (NOT OF RASTER)	SHIFT TO THE LEFT SIDE	
		VR401	SYNC LEVEL	THRESHOLD ADJUSTMENT OF SYNC SEPARATION	MORE SENSITIVE (FOR SMALLER INPUT)	
			BRIGHTNESS	BRIGHTNESS (R.G.B COMMON, BLACK LEVEL) CONTROL	BRIGHTER	REMOTE PANEL (5 kΩ)
		VR101	R.LEVEL	BRIGHTNESS CONTROL OF RED VIDEO SIGNAL	BRIGHTER	
		VR201	G.LEVEL	BRIGHTNESS CONTROL OF GREEN VIDEO SIGNAL	BRIGHTER	
		VR301	B.LEVEL	BRIGHTNESS CONTROL OF BLUE VIDEO SIGNAL	BRIGHTER	
		VR103	R.GAIN	WHITE BALANCE TRACKING ADJ. ON BRIGHTNESS CHANGE	EMPHASIZE RED	
		VR203	G.GAIN	FROM MAX TO MIN LUMINANCE	EMPHASIZE GREEN	
		VR303	B.GAIN		EMPHASIZE BLUE	
		VC101 VC201 VC301		FREQUENCY RESPONSE ADJ. OF VIDEO AMP CIRCUIT		Should not be changed
	FVD300	VC102 VC202 VC302				

VIDEO BOARD (2/2)

NO.	DESIGNATION			FUNCTIONAL DESCRIPTION	POLARITY (CCW) (CW) MIN. MAX.	REMARKS ADJ. PROCEDURE
	PCB	DEVICE NO.	SYMBOL NAME			
	FVD300	SW101	R TERMINATION	TERMINATION SELECTION OF RED SIGNAL INPUT	UP : 75Ω DOWN : HIGH	
		SW201	G TERMINATION	TERMINATION SELECTION OF GREEN SIGNAL INPUT	UP : 75Ω DOWN : HIGH	
		SW301	B TERMINATION	TERMINATION SELECTION OF BLUE SIGNAL INPUT	UP : 75Ω DOWN : HIGH	
		SW401	S TERMINATION	TERMINATION SELECTION OF EXTERNAL SYNC INPUT	UP : 75Ω DOWN : HIGH	
		VR102	R BACKGND	WHITE BALANCE CONTROL OF RASTER AT BRIGHTNESS (ON THE REMOTE PANEL) IS MAX.	EMPHASIZE RED	
		VR202	G BACKGND		EMPHASIZE GREEN	
		VR302	B BACKGND		EMPHASIZE BLUE	
		L101 L201 L301		FREQUENCY RESPONSE ADJ. OF VIDEO AMP CIRCUIT		Should not be changed
	FVD300	L102 L202 L302				

CRT SOCKET BOARD (1/1)

NO.	DESIGNATION			FUNCTIONAL DESCRIPTION	POLARITY (CCW) (CW) MIN. MAX.	REMARKS ADJ. PROCEDURE
	PCB	DEVICE NO.	SYMBOL NAME			
	FCS200	VR 1	G2 BIAS	VOLTAGE ADJUSTMENT OF CRT G2 BIAS CIRCUIT	BRIGHTER	

DEFLECTION BOARD (1/1)

NO.	DESIGNATION			FUNCTIONAL DESCRIPTION	POLARITY (CCW) (CW) MIN. MAX.	REMARKS ADJ. PROCEDURE
	PCB	DEVICE NO.	SYMBOL NAME			
	FDF300	VR 2	H-HOLD	HORIZONTAL FREQUENCY ADJ. TO HOLD STABLE PICTURE	HIGHER FREQ.	
		VR12	SPCC	SIDE PINCUTION COMPENSATION TO GET SQUARE RASTER		
		VR13	WIDTH	RASTER WIDTH CONTROL	WIDER RASTER SIZE	
		VR 8	V-HOLD	VERTICAL FREQUENCY ADJ. TO HOLD STABLE PICTURE	HIGHER FREQ.	
		L5	H-LINEARITY	HORIZONTAL LINEARITY COMPENSATION		
		VR 3	HV ADJ	VOLTAGE ADJUSTMENT	HIGHER VOLTAGE	Anode voltage = 27.0kV Should not be changed
		VR 4	HV TRIP	TRIP VOLTAGE ADJUSTMENT OF HIGH VOLTAGE CIRCUIT	HIGHER VOLTAGE	Trip voltage = 30 kV Should not be changed
		VR 6	H-CENTER	HORIZONTAL CENTERING OF RASTER SCAN AREA	SHIFT TO THE RIGHT SIDE	
		VR 9	HEIGHT	RASTER HEIGHT CONTROL	HIGHER SIZE	
		VR14	V-LINEARITY	VERTICAL LINEARITY COMPENSATION	SHOWN TABLE 4-1	
		VR10	V-CENTER	VERTICAL CENTERING OF RASTER SCAN AREA	UPPER SIDE	
	FDF300	VR15	VD1-ADJ	VOLTAGE ADJUSTMENT OF CRT G1 BIAS CIRCUIT	BRIGHTER	

4.5 TUBE

The tube is an in-line gun type, and normally needs no adjustment (of purity and static convergence, for example) by the user. If any adjustment is required of this tube, it is normally recommended that it be returned to the factory without trying to adjust it by yourself. But if required, please adjust CRT tube by referring to following information. Magnetic ring alignment are shown in Figure 4-5.

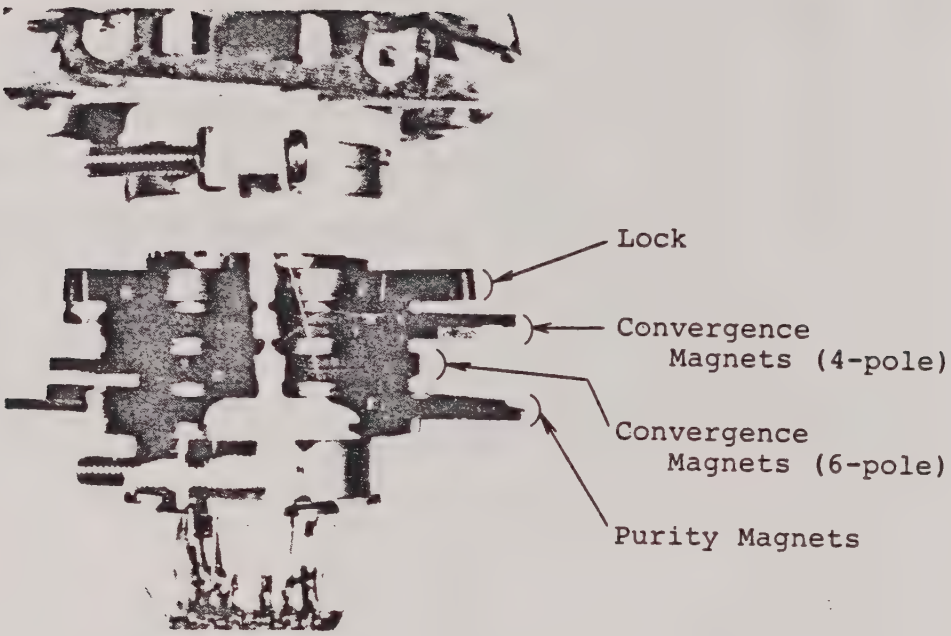


Figure 4-5 Mangetic Rings

4.5.1 Purity

a. Purity adjustment for vertical center

Adjust the HEIGHT control to get the minimum height of the picture which will form a narrow horizontal band in the center of the screen.

1) Do not turn the purity magnets if the horizontal band coincides with the horizontal line in the center of the screen as shown in Figure 4-6.

In this case, the purity magnet knobs should be set at 3 o'clock and 9 o'clock, respectively, as shown in Figure 4-7

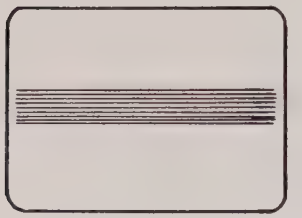


Fig. 4-6

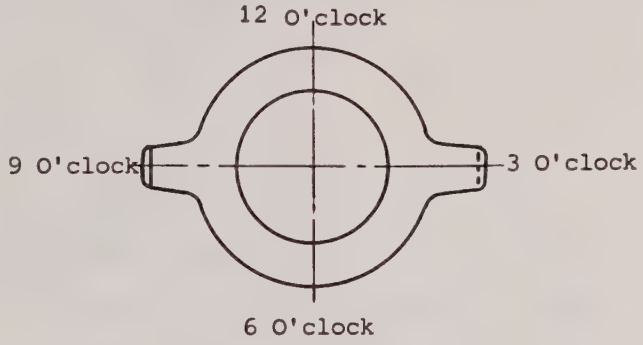


Fig. 4-7

2) If the horizontal band does not coincide with the horizontal line in the center of the screen, move each set of purity magnet knobs so that one set points to 12 o'clock and the other to 6 o'clock as shown in Figure 4-8.

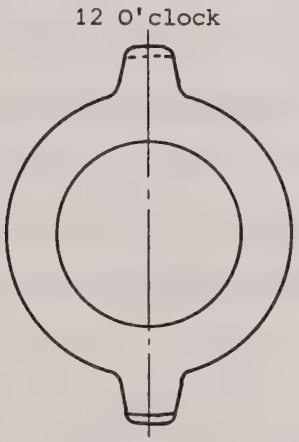


Fig. 4-8

Then, gradually adjust the knobs, making sure that the angles remain equal, until the horizontal band coincides with the horizontal center line as shown in Figure 4-9.

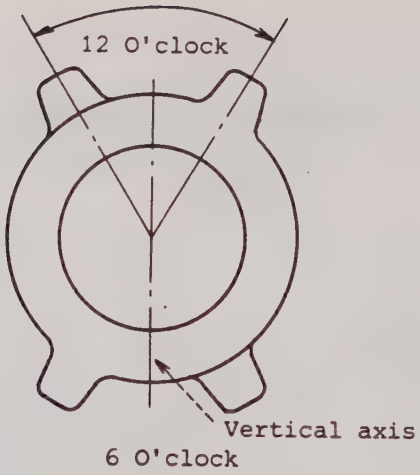


Fig. 4-9

b. Purity adjustment at the screen center

1) Put a monoscope pattern or blanking raster on the screen with a single beam from the green electron gun.

2) Move the deflection yoke backward or forward along the tube axis, until a green ball appears on the screen.

3) If the horizontal band coincides with the horizontal line in the center of the screen as shown in Figure 4-6, move the purity magnet knobs so that one set points to 3 o'clock and the other to 9 o'clock, keeping the angles equal (Figure 4-10)

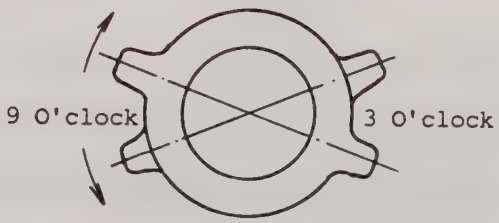


Fig. 4-10

until the green ball should be in the center of the screen as shown in Figure 4-11 .

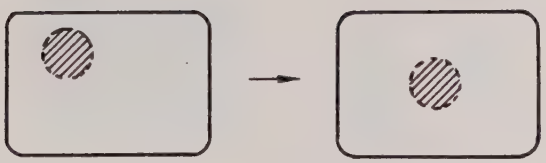


Fig. 4-11

4) If the horizontal band does not coincide with the horizontal line in the center of the screen, perform the adjustment in a 2). Then, move both sets of knobs simultaneously, keeping the angle equal until the green ball is in the center of the screen as shown in Figure 4-11.

5) Use a magnifier to make sure that the electron beam is striking the exact center of the screen.

c. Purity adjustment for the entire screen

1) Loosen the screw of the deflection yoke and gradually move it backward along the tube axis until the entire screen becomes green. If the deflection yoke is closely positioned to the neck, move it forward as close as possible to the funnel. Then, using a magnifier, check to make sure that the electron beam is squarely striking the phosphor dots on all sides of the screen.

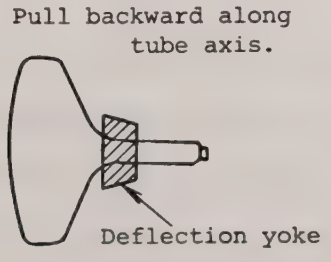


Fig. 4-12

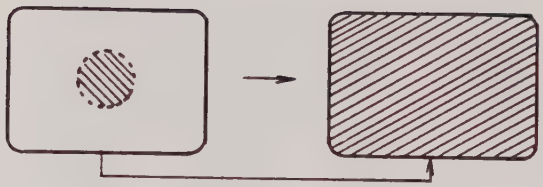


Fig. 4-13

2) Adjust the purity of the other two colors (Red and Blue), in the same way.

3) Recheck and readjust the vertical center of the horizontal band and repeat the same operation according to the same steps mentioned in c. 1) and c. 2).

4) Tighten the screw of the deflection yoke with a torque screwdriver set at a torque of 14 kg.cm.

4.5.2 Static Convergence

a. Adjust the cathode current so that the width of the cross-hatch lines (Red, Green and Blue) is from 6 to 8 phosphor dots.

b. Adjust focus voltage for the best focus.

c. Switch the green signal to the red and blue patterns, and repeat the same operations.

d. Carefully watch the intersection of cross-hatch pattern at the center of the screen and gradually move the knobs of two 4-pole magnets until there is no misconvergence between red and blue vertical lines as shown in Figure 4-14.

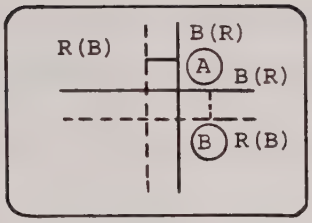


Fig. 4-14

e. Keep the angles of two 4-pole magnets constant and gradually move the knobs simultaneously until there is no misconvergence between red and blue horizontal lines as shown in Figure 4-14.

f. Put the R, G and B cross-hatch pattern on the screen again.

g. Gradually move the knobs of two 6-pole magnets until there is no misconvergence among the red, green and blue vertical lines at the center of the screen as shown in Figure 4-15.

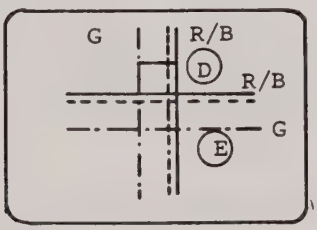


Fig. 4-15

h. Then, keeping the angle of two 6-pole magnets constant, gradually move them at the same time until there is no misconvergence among the red, green and blue horizontal

lines at the center of the screen as shown in Figure 4-15.

i. Repeat the above steps (d. through h.) to adjust the convergence at the center of the screen.

Reference: Changes in Beam Direction by Purity Magnet

This section describes the changes in beam direction caused by moving the purity magnet, 4-pole magnets and 6-pole magnets. The correction for static convergance and color purity required in this tube can be realized by permanent magnets. The purity magnets consists of magnetized metal rings.

Two types of magnets are recommended for static convergence, one is a 4-pole magnet which moves the outside beams equally in opposite directions and the other is a 6-pole magnet which moves the outside beams equally in the same direction, as shown in Figure 4-16 and Figure 4-17, respectively.

Fig. 4-16

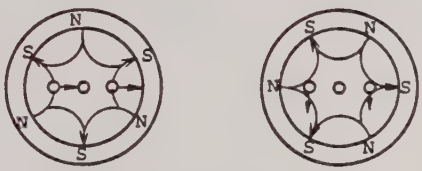


Fig. 4-17

Barium ferrite magnets with a permeability close to 1.0 are recommended to avoid interference between the magnets and the deflection yoke.

Both the 4-pole and 6-pole magnets have no magnetic field at their center so the center electron beam is unaffected. These magnet

can be used to converge the outside beams to the center beam without substantially moving the center beam, and thus no magnets are required in the electron gun itself. Consequently, the beams can be converged with practically no interference and minimum amount of bending of the beams. Therefore, there is very little distortion in the shape of the individual beams.

4.5.3 Dynamic Convergence

a. Tilt the deflection yoke upward or downward by turning the adjustment handle of the deflection yoke so that the misconvergence between the red and blue vertical cross-hatch lines at 1 and 1', and that between the red and blue horizontal cross-hatch lines at 2 and 2' are minimized as shown in Figure 4-18.

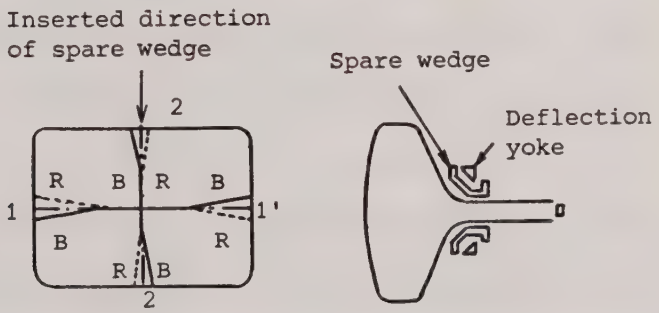


Fig. 4-18

b. After making the adjustment in step a, a residual misconvergence pattern will be either (a) or (b) as shown in Figure 4-19.

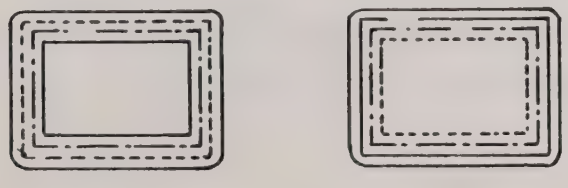


Fig. 4-19

If the red cross-hatch line deviates outside the blue cross-hatch line in the peripheral area as shown in Figure 4-19 (a), move the deflection yoke counter-clockwise (as viewed from the top of the tube) by rotating the adjustment handle of the deflection yoke, in order to minimize the misconvergence between the red and blue horizontal lines at the top and the bottom of the screen as well as the misconvergence between the red and blue vertical lines at the left and right of the screen.
If the blue line deviates outside the red line as shown in Figure 4-19 (b), move the deflection yoke clockwise (as viewed from the top of the tube).

c. Repeat the above steps a and b to adjust the convergence.

d. After convergence is adjusted, put the blanking signal for making the white raster on the screen.
Then, check the purity and vertical centering position*1 with the tube placeed in a north-south direction. (change the tube direction to an east-west direction*2 and perform degaussing respectively).

*1 : The equivalent magnetic field can be used. In this case, check the purity without changing the tube direction.

*2 : When the equivalent magnetic field is applied, degaussing is necessary.

4.5.4 Fixing the Magnets

a. Be careful not to move the 4-pole, 6-pole and purity magnets, and fix the magnet assemblies with respective locking ring.

b. Applly white paint on the magnet assemblies in order to prevent them from moving.

4.5.5 Final Fixing

a. A silicon adhesive sealer should be put on the wedge before it is inserted as shown in Figure 4-20.

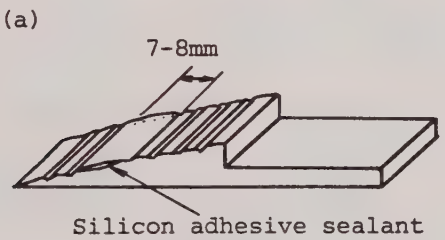


Fig. 4-20

b. Taking care not to move the deflection yoke, insert three wedges at angle of approximately 120° at a torque of 6 to 8 kg-cm as shown in Figure 4-21.

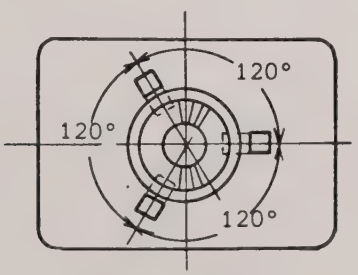


Fig. 4-21

c. After inserting the wedge, raise the end of each wedge and apply the silicon adhesive sealer between the wedge and the funnel as shown in Figure 4-22.

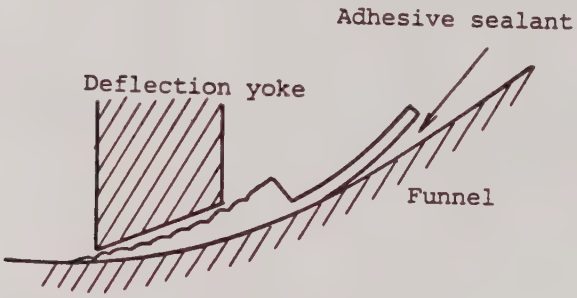


Fig. 4-22

d. Apply a piece of glass fiber tape to each wedge as shown in Figure 4-23.

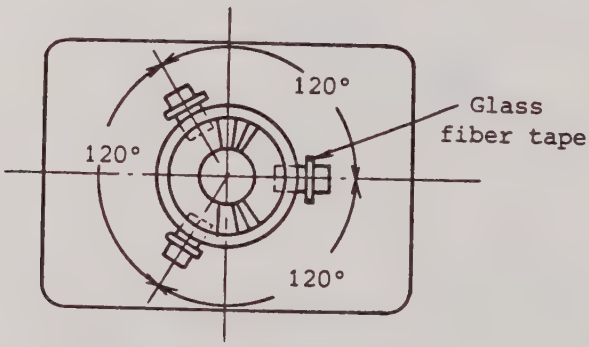


Fig. 4-23

5. REPLACEMENT AND ASSEMBLY

5.1 POWER SUPPLY MODULE

(1) Turn off the Power ON/OFF switch on the remote panel. (Fig. 5-1-a)

(2) Disconnect the AC power cord. (Fig. 5-1-b)

(3) Remove the upper cover. (Fig. 5-1-c)

(4) Remove two screw on both side of the power supply. (Fig. 5-1-b)

(5) Pull out the power supply about 5cm from the monitor.

(6) Remove connector ① ∿ ⑤. (Fig. 5-1-d)

(7) Remove the power supply by pulling it slowly.

To install the power supply, reverse the previous procedure from (1) to (7).

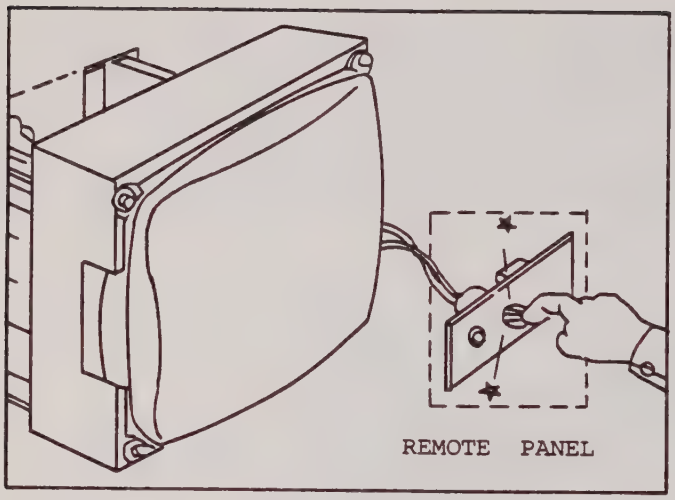


Fig. 5-1-a

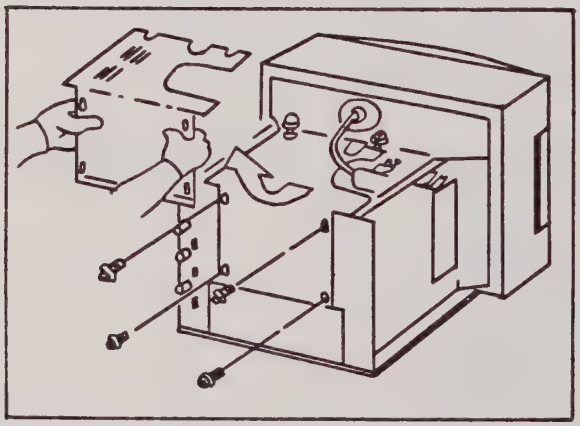


Fig. 5-1-c

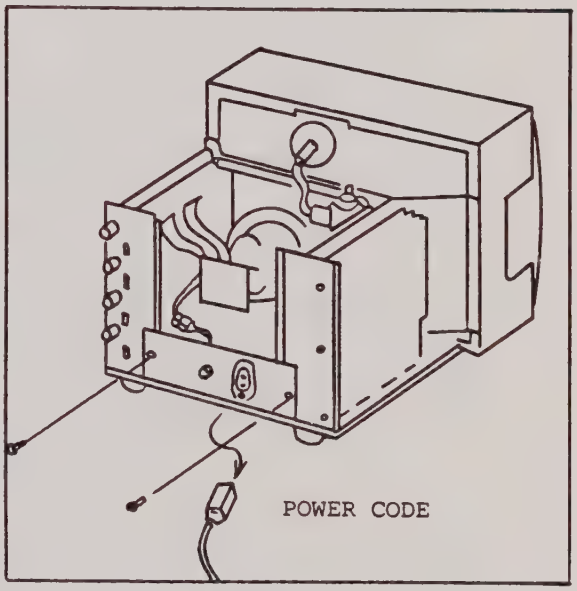


Fig. 5-1-b

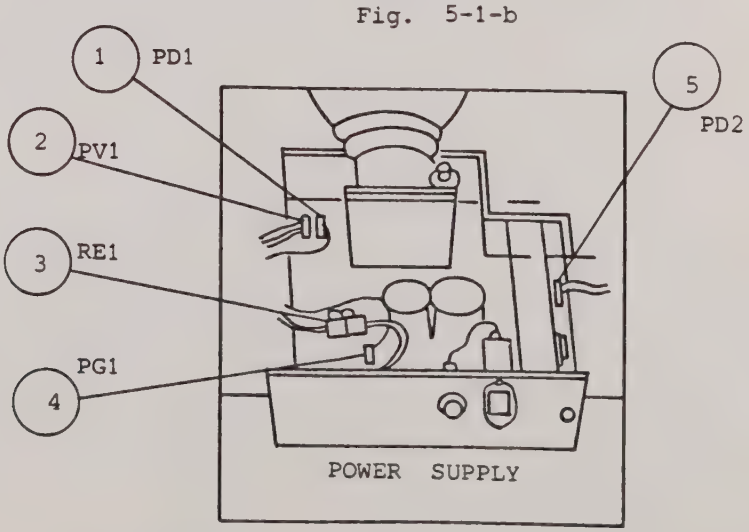


Fig. 5-1-d

5.2 VIDEO MODULE

(1) Remove four connectors R, G, B and EXT-SYNC. (Fig. 5-2-a)

(2) Remove the upper cover. (Fig. 5-2-b)

(3) Disconnect three connectors, ① VP1, ② VO1 and ③ VD1, from the video module. (Fig. 5-2-c)

(4) Disconnect three connectors, ④ AS1, ⑤ AS2, ⑥ AS3 from the video module with following attention. (Fig. 5-2-d)

(i) Lean the connector until it clicks.

(ii) Pull it up and disconnect.

(5) Remove nine screws. (Fig. 5-2-d)

(6) Put off the shield cables passing through the halls of PCB and chasis with much care not to be forcibly stressed.

(7) Remove the video module by pulling it toward the outside. (Fig. 5-2-e)

To install the video module, reverse the previous procedure from (1) to (6).

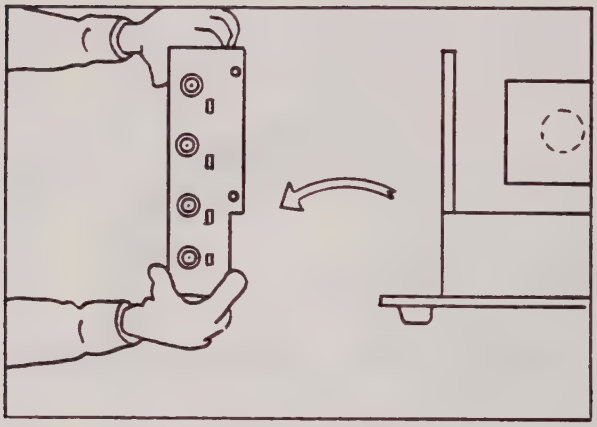


Fig. 5-2-e

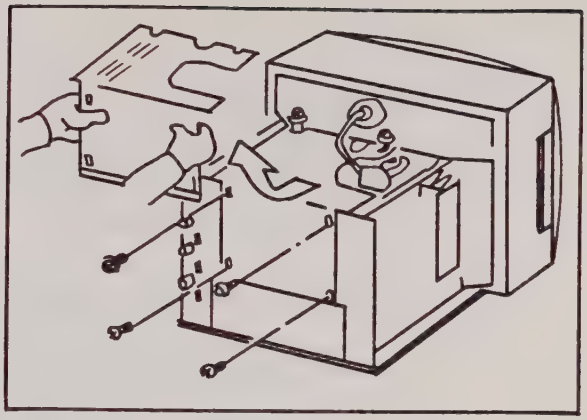


Fig. 5-2-b

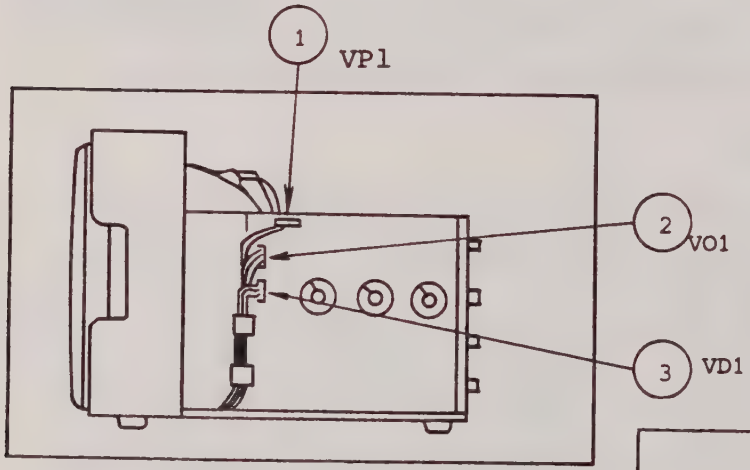


Fig. 5-2-c

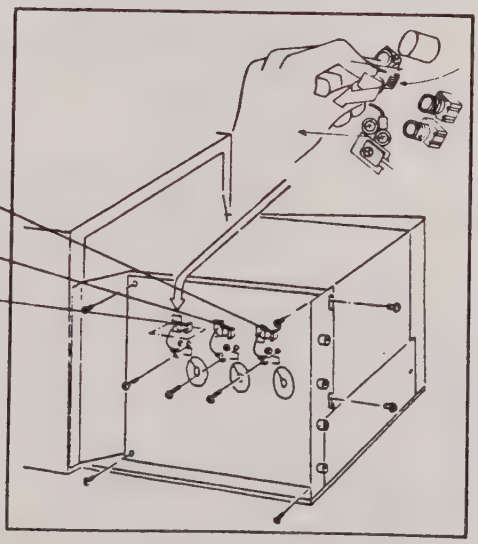


Fig. 5-2-d

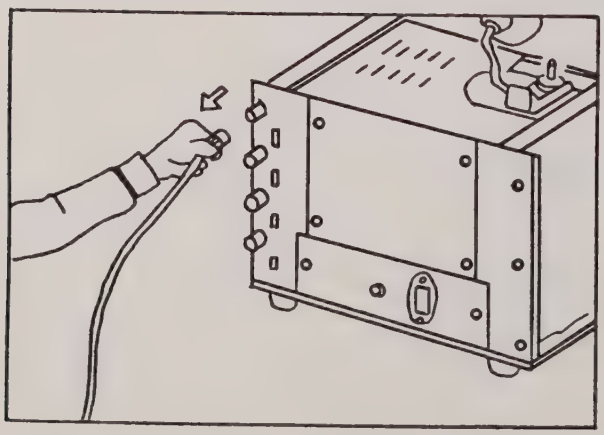


Fig. 5-2-a

5.3 DEFLECTION MODULE

(1) Remove the upper cover. (Fig. 5-3-a)

(2) Disconnect nine connectors, ① DY1, ② DY2, ③ DJ1, ④ DV1, ⑤ DP1, ⑥ DS2, ⑦ DS3, ⑧ DS1 form the deflection module and ⑨ PD2 from power supply module. (Fig. 5-3-b)

(3) Remove the anode cap at the rear of the tube.(Fig.5-3-c)

(4) Disconnect the focus connector from the focus block. (Fig. 5-3-d)

(5) Remove the focus block by removing two screws. (Fig. 5-3-d)

(6) Remove four screws. (Fig. 5-3-e)

(7) Gently extract the focusing block, anode cap and the flyback transformer from the opening at the lower portion of the side panel while removing DEF PI. (Fig. 5-3-f)
Remove the deflection module from the frame.

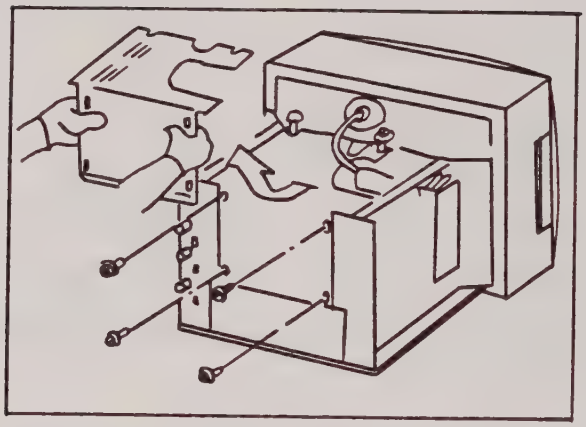


Fig. 5-3-a

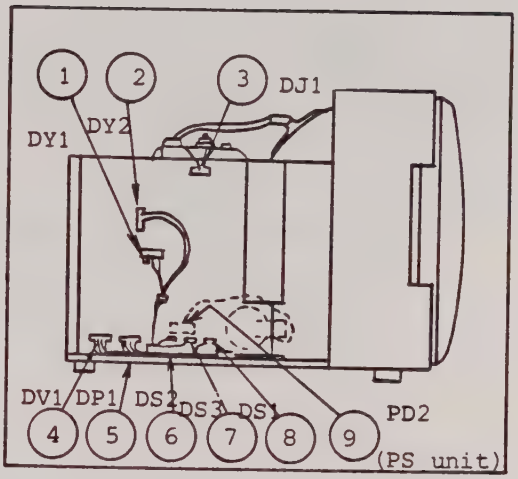


Fig. 5-3-b

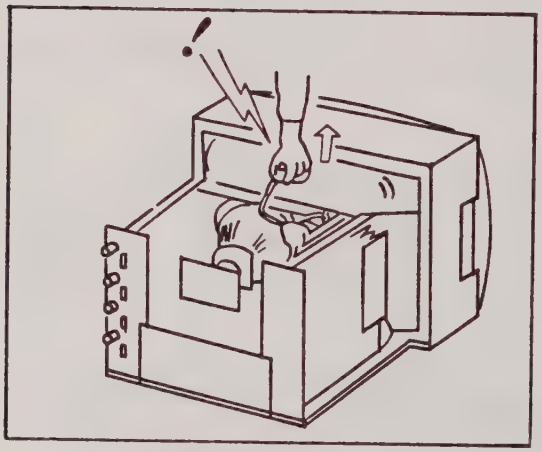


Fig. 5-3-c

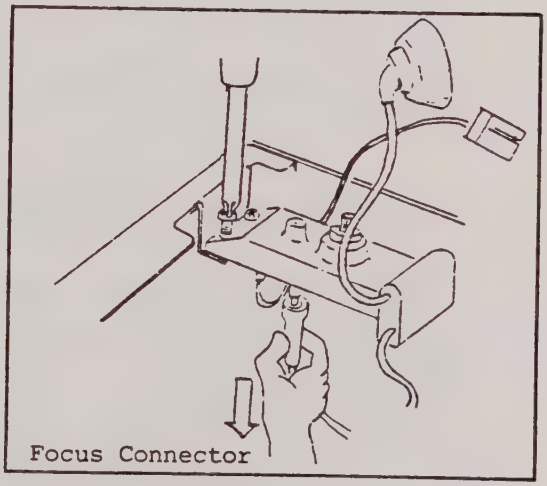


Fig. 5-3-d

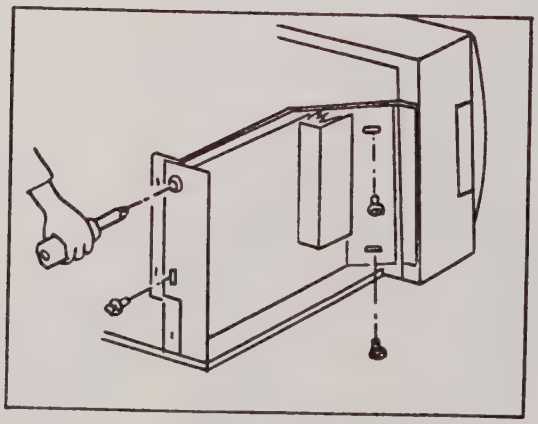


Fig. 5-3-e

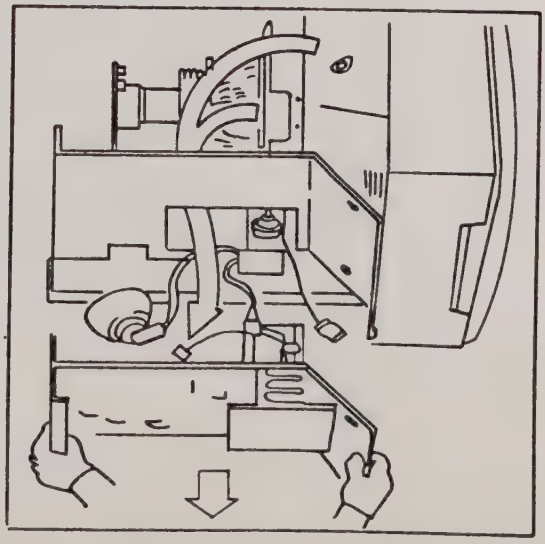


Fig. 5-3-f

5.4 SOCKET BOARD (Fig. 5-4)

(1) Remove the upper cover. (Fig. 5-2-b)

(2) Disconnect six connectors, ① SA2, ② SA1, ③ SA3 ④ SD2, ⑤ SD3 and ⑥ SD1 from the socket board FCS200 by holding the socket board tightly and not forcibly stressing to the tube. (Fig. 5-4-a, 5-4-b)

(3) Disconnect the focus connector ⑦ from the focus block.

(4) Remove the socket board slowly from the tube by pulling toward behind.

(5) Remove the Grounded wires by removing a screw (⑧).

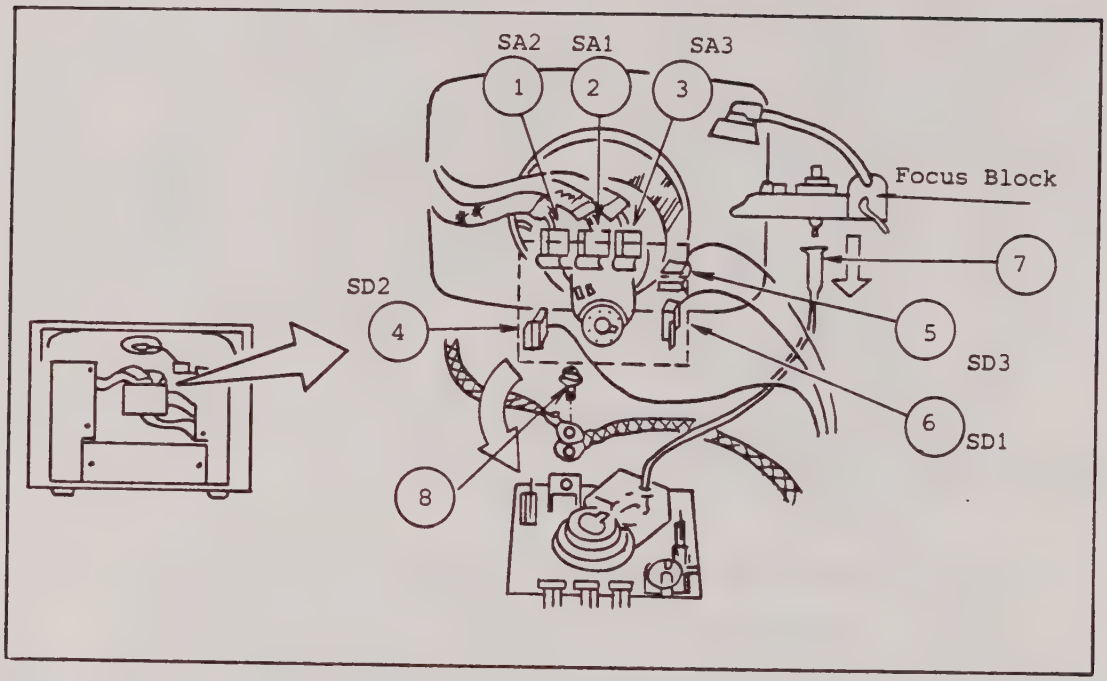


Fig. 5-4-a

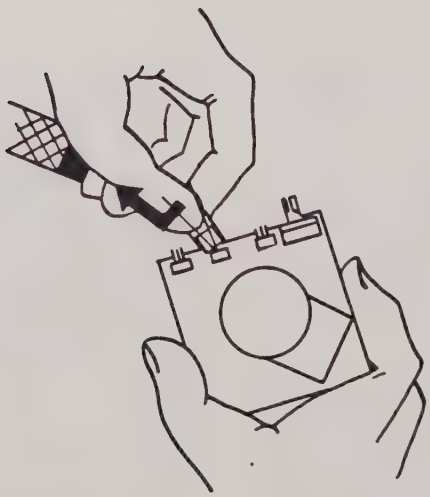


Fig. 5-4-b

5.5 TUBE

a. Precaution (Fig. 5-5-a)

1) The tube is made of glass, and in the vacuum state inside, therefore proper care should be taken when removing, installing and carrying it.

2) Do not touch the anode cap because of the high voltage involved.
The CRT tube is in the high voltage (27 kV) condition when used, therefore even when power is off, a high voltage electric charge may still be present on the CRT tube.
Please make sure all electric charge is completely discharged, when handling the CRT.
To discharge the CRT, ground the Anode contact through a 1 MΩ resister.

3) Care should be taken not to damage the tube face.

b. Procedure

1) Remove the Socket board FCS200 from the rear of the tube. (Refer 5.4 procedure)

2) Disconnect two connectors (1) DY1, (2) DY2 from the deflection module FDF300. (Fig. 5-5-b)

3) Remove the anode cap (3)
(Note: Proper care should be taken since a high voltage can remain after the power has been turned off.) (Fig. 5-5-b)

4) Disconnect the shield wire from the socket Board. (Fig. 5-5-b)

5) Remove the four tube holding bolts in the front 4 corners and pull the tube forward. (Fig. 5-5-c)

6) Remove the shield wire from the tube and install it on the new tube. (Fig. 5-5-d)

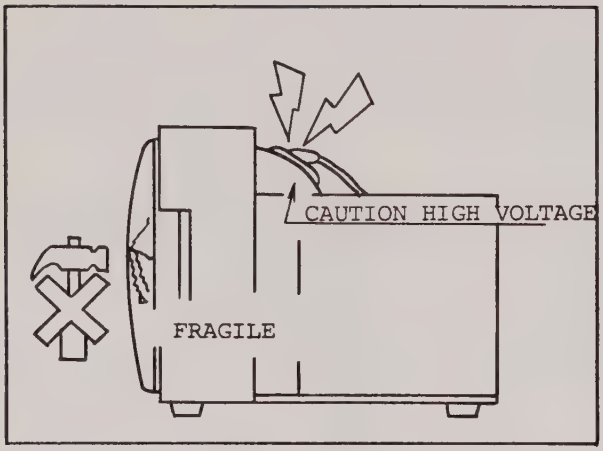


Fig. 5-5-a

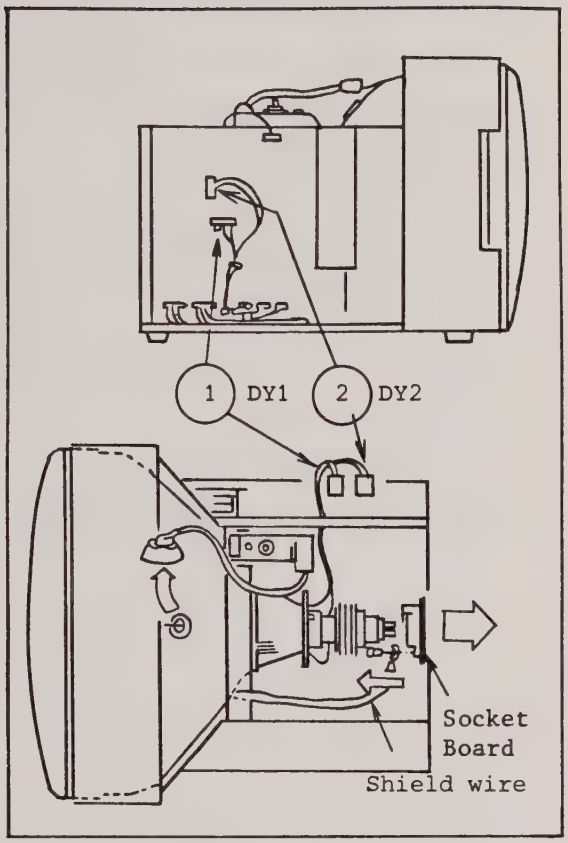


Fig. 5-5-b

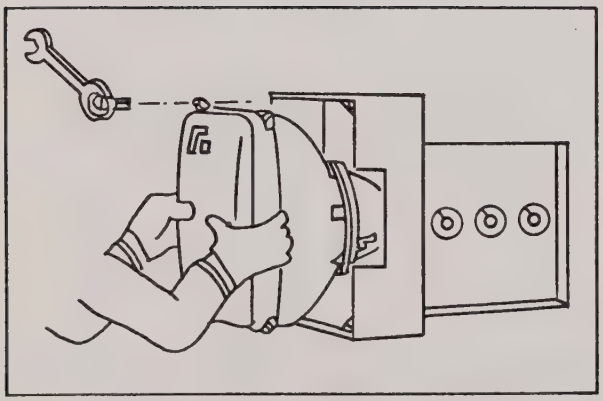


Fig. 5-5-c

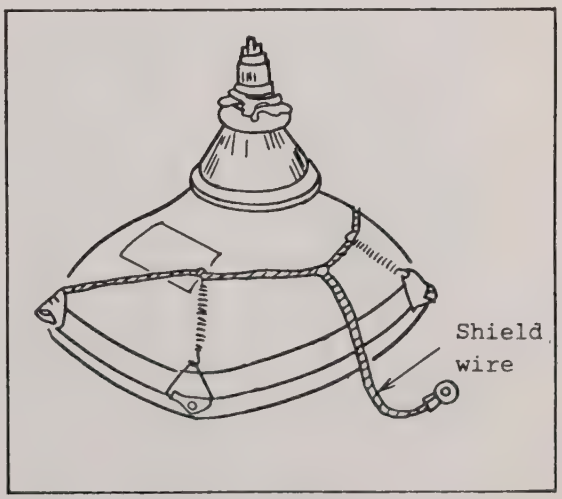


Fig. 5-5-d

6. MAINTENANCE

This chapter describes both preventive and corrective maintenance. Preventive maintenance is mainly concerned with monitor cleaning.

Corrective maintenance deals with fault isolation in reference to the waveforms.

Before beginning maintenance work, always make sure that AC power is turned off.

Maintenance personnel should refer to this chapter when performing maintenance procedures.

6.1 PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning the inside of the chassis, cleaning the screen face and checking the cable connections.

Environmental conditions will determine how often cleaning has to be done. Maintenance personnel are urged to refer to Section 2.2 "Installation Precautions".

6.2 CORRECTIVE MAINTENANCE

Corrective maintenance consists of the trouble shooting as described in the following table and Section 4 "ADJUSTMENT AND TEST".

Trouble shooting map

Trouble shooting procedure

(1) Find symptoms from left rows

(2) Trace the column from the symptoms along the column line. At the top column where "O" is marked, possible trouble reason and the remedy that is described.

(3) Pick up those remedies, and execute them. Let lefter Item be executed preceding the righter one, as the formar is easier remedy to execute.

ITEM	Installations				Protections & controls setting						Internal Adjustment	Defects						
Possible Reason / Corrective Action	Incorrect AC Range setting or Power source Apply Rated AC input (See 2.4.3)	Incorrect Signal wiring or termination setting Set to correct condition (See 2.4.2)	Signal Interface mismatch (level or timing) Apply Rated waveform (See 1.2.2.3)	Magnetic field from other monitors or Transformer Keep away from Magnetic source (See 2.1.1.6)	AC Input Fuse open Put the Rated Fuse (See 2.4.3)	Over Load protection caused by transient noise Put Power sw OFF and wait 3 minutes, then put it ON	Beam switch to OFF Beam switch to ON	Set up sw is set to the maintenance mode Set to the normal position		Brightness Control is set to minimum Set to the Optimum range	Adjustment is not fair. Refer to the adjustment Description Listed in each Rows and Readjust.	Deflection Module Replace the module.	Video Amp. Module		Power Supply Module	CRT Socket Board	CRT Tube with Yoke	Inter Connections
Picture doesn't appear — Power indicator is OFF	○				○	○[1]						○[1]	○[1]		○			
Power indicator is ON						○	○			○		○				○	○	
Picture Rolls or no synchronization is obtained		○									○ (See 4.4.1)	○	○					
Picture size has not correct aspect			○								○ (See 4.4.4)	○						
Picture position is not centered			○	○							○ (See 4.4.2 and 4.4.3)	○						
Cross hatch vertical line is not straight				○	○						○ (See 4.4.4)	○						
Line pitch is not equal				○							○ (See 4.4.4)	○						
Picture is too bright or dark		○	○							○	○ (See 4.4.5)		○					
Some of 3 color beams are lacked		○					○				○ (See 4.4.5)		○					
White Balance is bad			○								○ (See 4.4.5)		○					
White Uniformity (Purity) is bad				○							○ (See 4.2)							
Convergence is bad				○							○ (See 4.4.5)				○		○	
Not sharp image (Focus is bad)			○								○ (See 4.4.6)	○				○	○	
Overshoot or smear appears		○	○										○				○	
Picture noise Optical Fluctuation	○	○									○ (See 4.4.5)		○					
Back level changes			○								○ (See 4.4.5)		○					
Colored Raster			○												○			
Retrace raster appears			○								○ (See 4.4.2 and 4.4.3)	○	○					
Picture noise geometrical Jitter or wave on top			○								○ (See 4.4.1)	○						
Fluctuation	○		○	○								○			○			

Note 1

Over Load protection in PS module may be working caused by defect in these module, which can be Localized by removing the power connector from PS to each modules.

APPENDIX I.

RECOMMENDED SPARE PARTS

Part No.	Description
137-001	19" Long persistence phosphor color picture tube
137-00B	19" Long persistence phosphor color picture tube (with A/R coating panel)
237-000	Video module
237-050	Deflection module
237-060	Socket board
337-000	Power supply module

APPENDIX II

PARTS LIST

II-1 Overall 101

Power Supply Module 101

II-2 Printed Circuit Board 102

Video Amp : FVD300 102

Deflection : FDF300 109

Socket Board : FCS200 113

Power Supply : FPS300 114

Note: Components marked with "*" have special characteristics important to safety. Before replacing any of these components, read carefully the PRODUCT SAFETY NOTICE of this Manual. Don't degrade the safety of the color monitor through improper servicing.

The parts designation and symbols used in Parts List are defined as bellow.

SYMBOL

Q	TRANSISTOR
IC	INTEGRATED CIRCUIT
D	DIODE
ZD	ZENER DIODE
R	RESISTOR
C	CAPACITOR
VR	VARIABLE RESISTOR
VC	VARIABLE CAPACITOR
L	INDUCTOR
TR	TRANSFORMER
SW	SWITCH

TOLERANCE

F	± 1 %
G	± 2 %
J	± 5 %
K	±10 %
M	±20 %
Z	+80 ∿ -20 %
Y	-10 ∿ +30 %
X	-10 ∿ +50 %

TYPE CLASSIFICATION

R	MX	METAL OXIDE FILM
	MF	METAL FILM
	WW	WIRE WOUND
	CF	CARBON FILM
	CS	CARBON SOLID
	FR	FUSE RESISTOR
C	AL	ALUMINUM
	TA	TANTALUM
	CR	CERAMIC
	MY	MICA
	PE	POLYESTER
	PP	POLYPROPYLENE
	OP	OIL FILLED PAPER

II-1 OVERALL

	PARTS NO.	
*CRT (Cathod Ray Tube)	137-001	19" LPP CRT
	137-00B	(with A/R Coat)
DEGAUSS COIL		SA70555A
VIDEO AMP.	237-000	FVD300
DEFLECTION	237-050	FDF300
Socket Board	237-060	FCS200
Power Supply Module	337-000	SG-2W80
Cable (PD1-DP1)		TA56577A
(PV1-VP1)		TA56576A
(DS1-SD1)		TA56703A
(DS2-SD2)		TA56702A
(DS3-SD3)		TA56704A
(DV1-VD1)		TA56700A
(AS1-SA1)		SA70554A
(AS2-SA2)		SA70554B
(AS3-SA3)		SA70554C
(X1-RE1)		TA56766A
(X2-V01)		TA56705A
(DY1, DY2)		SA70476A

POWER SUPPLY MODULE

PARTS NAME		PARTS NO.	DESCRIPTION
POWER SUPPLY P.C.B.			FPS300
CONNECTOR & FILTER	LF1		ZUB2203-00
FUSE	F1		MGC4 (AC 250V/4A)
FUSE HOLDER	(F1)		FH002
CONNECTOR	PP2		5P-SVF
	RE1		MLR-06

SYMBOL NO.	PART NO.	DESCRIPTION
Transistor		
Q101		2SK168F
Q102		2SA781 K
Q103		2SA781 K
Q104		2SC2408
Q105		2SA781 K
Q106		2SC2407
Q107		2SD655F
Q108		2SC2407(1)
Q109		2SA711
Q111		2SK352
Q112		2SC1252
Q113		2SD756AD
Q201		2SK168F
Q202		2SA781 K
Q203		2SA781 K
Q204		2SC2408
Q205		2SA781 K
Q206		2SC2407
Q207		2SD655F
Q208		2SC2407(1)
Q209		2SA711
Q211		2SK352
Q212		2SC1252
Q213		2SD756AD
Q301		2SK168F
Q302		2SA781 K
Q303		2SA781 K
Q304		2SC2408
Q305		2SA781 K
Q306		2SC2407
Q307		2SD655F
Q308		2SC2407(1)
Q309		2SA711
Q311		2SK352
Q312		2SC1252
Q313		2SD756AD
Q401		2SK168F
Q402		2SK168F
Q403		2SA1188E
Q404		2SC2396F
IC		
IC101		μPC1251C
IC102		HD14016BP
IC201		μPC1251C
IC202		HD14016BP
IC301		μPC1251C
IC302		HD14016BP
IC401		LM319N
IC402		HD74123P
IC403		HD74123P
IC404		HD74123P
IC405		HD7474P
IC406		HD7426P
IC407		HD7404P
Diode		
D101		1SS83
D102		1SS83
D103		V06C
D201		1SS83

SYMBOL NO.	PART NO.	DESCRIPTION		
Diode				
D202		1SS83		
D203		V06C		
D301		1SS83		
D302		1SS83		
D303		V06C		
Zener Diode				
ZD101		HZ-6LC1		
ZD201		HZ-6LC1		
ZD301		HZ-6LC1		
Resistor				
R101		MX	1W, 75 ohm	G
R102		CF	1/2W, 120 ohm	J
R103		CF	1/4W, 51 kohm	J
R104		CF	1/4W, 100 kohm	J
R105		CF	1/4W, 1.2 kohm	J
R106		CF	1/2W, 75 ohm	J
R107		CF	1/2W, 270 ohm	J
R108		CF	1/2W, 300 ohm	J
R109		CF	1/4W, 3.9 kohm	J
R110		CF	1/2W, 75 ohm	J
R111		CF	1/4W, 10 kohm	J
R112		CF	1/2W, 270 ohm	J
R113		CF	1/2W, 300 ohm	J
R114		CF	1/2W, 300 ohm	J
R115		CF	1/2W, 620 ohm	J
R116		MX	1/2W, 30 kohm	J
R117		MX	1/2W, 6.8 kohm	J
R118		MX	1/2W, 47 ohm	J
R119		MX	1/2W, 390 ohm	J
R120		MX	1/2W, 100 ohm	J

SYMBOL NO.	PART NO.	DESCRIPTION		
R121		MX	1/2W, 680 ohm	J
R122		MX	1/2W, 51 ohm	J
R123		MX	1/2W, 820 ohm	J
R124		MX	1/2W, 470 ohm	J
R125		MF	1/2W, 5.6 ohm	J
R126		MF	1/2W, 5.6 ohm	J
R127		MF	1/2W, 3 ohm	J
R128		MX	1/2W, 1.8 kohm	J
R129		MX	1/2W, 10 ohm	J
R130		MX	1/2W, 10 ohm	J
R131		MX	1/2W, 100 ohm	J
R132		MX	1/2W, 390 ohm	J
R133		MX	7W, 1.2 kohm	J
R134		MX	7W, 1.2 kohm	J
R135		MX	1/2W, 100 ohm	J
R136		CF	1/2W, 24 kohm	J
R141		CF	1/4W, 2.7 kohm	J
R142		CF	1/2W, 1 kohm	J
R143		CF	1/4W, 100 ohm	J
R144		CF	1/4W, 3.9 kohm	J
R145		CF	1/4W, 6.2 kohm	J
R146		CF	1/4W, 6.2 kohm	J
R147		CF	1/4W, 1 kohm	J
R148		CF	1/4W, 1 kohm	J
R149		CF	1/4W, 100 kohm	J
R150		MX	7W, 2 kohm	J
R201		MX	1W, 75 ohm	G
R202		CF	1/2W, 120 ohm	J
R203		CF	1/4W, 51 kohm	J
R204		CF	1/4W, 100 kohm	J
R205		CF	1/4W, 1.2 kohm	J
R206		CF	1/2W, 75 ohm	J

SYMBOL NO.	PART NO.	DESCRIPTION			SYMBOL NO.	PART NO.	DESCRIPTION		
Resistor									
R207		CF	1/2W, 270 ohm	J	R246		CF	1/4W, 6.2 kohm	J
R208		CF	1/2W, 300 ohm	J	R247		CF	1/4W, 1 kohm	J
R209		CF	1/4W, 3.9 kohm	J	R248		CF	1/4W, 1 kohm	J
R210		CF	1/2W, 75 ohm	J	R249		CF	1/4W, 100 kohm	J
R211		CF	1/4W, 10 kohm	J	R250		MX	7W, 2 kohm	J
R212		CF	1/2W, 270 ohm	J					
R213		CF	1/2W, 300 ohm	J					
R214		CF	1/2W, 300 ohm	J					
R215		CF	1/2W, 620 ohm	J	R301		MX	1W, 75 ohm	G
R216		MX	1/2W, 30 kohm	J	R302		CF	1/2W, 120 ohm	J
R217		MX	1/2W, 6.8 kohm	J	R303		CF	1/4W, 51 kohm	J
R218		MX	1/2W, 47 ohm	J	R304		CF	1/4W, 100 kohm	J
R219		MX	1/2W, 390 ohm	J	R305		CF	1/4W, 1.2 kohm	J
R220		MX	1/2W, 100 ohm	J	R306		CF	1/2W, 75 ohm	J
R221		MX	1/2W, 680 ohm	J	R307		CF	1/2W, 270 ohm	J
R222		MX	1/2W, 51 ohm	J	R308		CF	1/2W, 300 ohm	J
R223		MX	1/2W, 820 ohm	J	R309		CF	1/4W, 3.9 kohm	J
R224		MX	1/2W, 470 ohm	J	R310		CF	1/2W, 75 ohm	J
R225		MF	1/2W, 5.6 ohm	J	R311		CF	1/4W, 10 kohm	J
R226		MF	1/2W, 5.6 ohm	J	R312		CF	1/2W, 270 ohm	J
R227		MF	1/2W, 3 ohm	J	R313		CF	1/2W, 300 ohm	J
R228		MX	1/2W, 1.8 kohm	J	R314		CF	1/2W, 300 ohm	J
R229		MX	1/2W, 10 ohm	J	R315		CF	1/2W, 620 ohm	J
R230		MX	1/2W, 10 ohm	J	R316		MX	1/2W, 30 kohm	J
R231		MX	1/2W, 100 ohm	J	R317		MX	1/2W, 6.8 kohm	J
R232		MX	1/2W, 390 ohm	J	R318		MX	1/2W, 47 ohm	J
R233		MX	7W, 1.2 kohm	J	R319		MX	1/2W, 390 ohm	J
R234		MX	7W, 1.2 kohm	J	R320		MX	1/2W, 100 ohm	J
R235		MX	1/2W, 100 ohm	J	R321		MX	1/2W, 680 ohm	J
R236		CF	1/2W, 24 kohm	J	R322		MX	1/2W, 51 ohm	J
					R323		MX	1/2W, 820 ohm	J
R241		CF	1/4W, 2.7 kohm	J	R324		MX	1/2W, 470 ohm	J
R242		CF	1/2W, 1 kohm	J	R325		MF	1/2W, 5.6 ohm	J
R243		CF	1/4W, 100 ohm	J	R326		MF	1/2W, 5.6 ohm	J
R244		CF	1/4W, 3.9 kohm	J	R327		MF	1/2W, 3 ohm	J
R245		CF	1/4W, 6.2 kohm	J	R328		MX	1/2W, 1.8 kohm	J

SYMBOL NO.	PART NO.	DESCRIPTION		
Resistor				
R329		MX	1/2W, 10 ohm	J
R330		MX	1/2W, 10 ohm	J
R331		MX	1/2W, 100 ohm	J
R332		MX	1/2W, 390 ohm	J
R333		MX	7W, 1.2 kohm	J
R334		MX	7W, 1.2 kohm	J
R335		MX	1/2W, 100 ohm	J
R336		CF	1/2W, 24 kohm	J
R341		CF	1/4W, 2.7 kohm	J
R342		CF	1/2W, 1 kohm	J
R343		CF	1/4W, 100 ohm	J
R344		CF	1/4W, 3.9 kohm	J
R345		CF	1/4W, 6.2 kohm	J
R346		CF	1/4W, 6.2 kohm	J
R347		CF	1/4W, 1 kohm	J
R348		CF	1/4W, 1 kohm	J
R349		CF	1/4W, 100 kohm	J
R403		CF	1/4W, 1 kohm	J
R404		CF	1/4W, 82 kohm	J
R405		CF	1/4W, 82 kohm	J
R406		CF	1/2W, 620 ohm	J
R407		CF	1/2W, 300 ohm	J
R408		CF	1/4W, 10 kohm	J
R409		CF	1/4W, 5.1 kohm	J
R410		CF	1/4W, 1 kohm	J
R411		CF	1/4W, 100 ohm	J
R412		CF	1/4W, 10 kohm	J
R413		CF	1/2W, 220 ohm	J
R414		CF	1/4W, 39 kohm	J
R415		CF	1/4W, 82 kohm	J
R416		CF	1/2W, 620 ohm	J
R417		CF	1/4W, 2 kohm	J
R418		CF	1/4W, 12 kohm	J
R419		CF	1/4W, 100 ohm	J

SYMBOL NO.	PART NO.	DESCRIPTION		
Resistor				
R420		CF	1/4W, 5.1 kohm	J
R431		MX	1W, 75 ohm	G
R422		CF	1/4W, 10 kohm	J
R424		CF	1/4W, 39 kohm	J
R425		CF	1/2W, 1 kohm	J
R427		CF	1/4W, 27 kohm	J
R428		CF	1/4W, 10 kohm	J
R430		CF	1/4W, 1 kohm	J
R432		CF	1/2W, 30 kohm	J
R433		CF	1/4W, 27 kohm	J
R434		CF	1/4W, 1 kohm	J
R435		CF	1/4W, 3 kohm	J
R437		CF	1/4W, 100 ohm	J
R438		CF	1/4W, 6.2 kohm	J
R439		CF	1/2W, 820 ohm	J
Capacitor				
C101		AL	16 V, 22 µF	M
C102		CR	50 V, 0.01 µF	Z
C104		AL	16 V, 33 µF	M
C106		CR	50 V, 0.01 µF	Z
C107		CR	50 V, 0.01 µF	Z
C108		AL	16 V, 100 µF	M
C109		AL	16V, 47 µF	M
C110		CR	50 V, 0.01 µF	Z
C111		TA	16 V, 3.3 µF	M
C112		CR	50 V, 0.01 µF	Z
C113		AL	16 V, 100 µF	M

SYMBOL NO.	PART NO.	DESCRIPTION		
Capacitor				
C114		CR	50 V, 0.01 µF	Z
C115		TA	16 V, 3.3 µF	M
C116		CR	50 V, 2200 PF	K
C118		CR	50 V, 0.1 µF	M
C119		PE	200 V, 0.1 µF	K
C120		CR	500 V, 2200 PF	K
C121		AL	160 V, 10 µF	Y
C122		PE	200 V, 0.1 µF	K
C123		AL	160 V, 10 µF	Y
C126		CR	50 V, 0.1 µF	M
C127		CR	50 V, 0.1 µF	M
C131		PE	50 V, 4700 PF	K
C132		AL	16 V, 33 µF	M
C133		CR	50 V, 100 PF	K
C134		AL	16 V, 100 µF	M
C135		CR	50 V, 0.01 µF	Z
C201		AL	16 V, 22 µF	M
C202		CR	50 V, 0.01 µF	Z
C204		AL	16 V, 33 µF	M
C206		CR	50 V, 0.01 µF	Z
C207		CR	50 V, 0.01 µF	Z
C208		AL	16 V, 100 µF	M
C209		AL	16 V, 47 µF	M
C210		CR	50 V, 0.01 µF	Z
C211		TA	16 V, 3.3 µF	M
C212		CR	50 V, 0.01 µF	Z
C213		AL	16 V, 100 µF	M
C214		CR	50 V, 0.01 µF	Z
C215		TA	16 V, 3.3 µF	M
C216		CR	50 V, 2200 PF	K

SYMBOL NO.	PART NO.	DESCRIPTION		
C218		CR	50 V, 0.1 µF	M
C219		PE	200 V, 0.1 µF	K
C220		CR	500 V, 2200 PF	K
C221		AL	160 V, 10 µF	Y
C222		PE	200 V, 0.1 µF	K
C223		AL	160 V, 10 µF	Y
C226		CR	50 V, 0.1 µF	M
C227		CR	50 V, 0.1 µF	M
C231		PE	50 V, 4700 PF	K
C232		AL	16 V, 33 µF	M
C233		CR	50 V, 10 PF	J
C234		AL	16 V, 100 µF	M
C235		CR	50 V, 0.01 µF	Z
C301		AL	16 V, 22 µF	M
C302		CR	50 V, 0.01 µF	Z
C304		AL	16 V, 33 µF	M
C306		CR	50 V, 0.01 µF	Z
C307		CR	50 V, 0.01 µF	Z
C308		AL	16 V, 100 µF	M
C309		AL	16 V, 47 µF	M
C310		CR	50 V, 0.01 µF	Z
C311		TA	16 V, 3.3 µF	M
C312		CR	50 V, 0.01 µF	Z
C313		AL	16 V, 100 µF	M
C314		CR	50 V, 0.01 µF	Z
C315		TA	16 V, 3.3 µF	M
C316		CR	50 V, 2200 PF	K
C318		CR	50 V, 0.1 µF	M
C319		PE	200 V, 0.1 µF	K
C320		AL	500 V, 2200 PF	K
C321		AL	160 V, 10 µF	Y

SYMBOL NO.	PART NO.	DESCRIPTION		
Capacitor				
C322		PE	200 V, 0.1 µF	K
C323		AL	160 V, 10 µF	Y
C326		CR	50 V, 0.1 µF	M
C327		CR	50 V, 0.1 µF	M
C331		PE	50 V, 4700 PF	K
C332		AL	16 V, 33 µF	M
C333		CR	50 V, 100 PF	K
C334		AL	16 V, 100 µF	M
C335		CR	50 V, 0.1 µF	Z
C401		CR	50 V, 0.01 µF	Z
C404		AL	16 V, 10 µF	M
C405		AL	16 V, 100 µF	M
C406		CR	50 V, 0.1 µF	M
C407		CR	50 V, 0.01 µF	Z
C408		CR	50 V, 0.1 µF	M
C409		CR	50 V, 0.1 µF	M
C410		AL	16 V, 33 µF	M
C411		AL	16 V, 10 µF	M
C412		AL	10 V, 33 µF	M
C414		CR	50 V, 0.1 µF	M
C415		MY	300 V, 510 PF	J
C416		CR	50 V, 0.1 µF	M
C417		PE	50 V, 0.068 µF	K
C418		CR	50 V, 0.1 µF	M
C419		PE	50 V, 3300 PF	K
C420		PE	50 V, 1000 PF	K
C430		CR	50 V, 0.1 µF	M
C432		PE	50 V, 1000 PF	K
C433		CR	50 V, 0.1 µF	M
C434		PE	50 V, 0.068 µF	K
C435		CR	50 V, 0.1 µF	M
C437		CR	50 V, 0.1 µF	M
C439		AL	10 V, 100 µF	M
C440		AL	16 V, 220 µF	M

SYMBOL NO.	PART NO.	DESCRIPTION
Variable Resistor		
VR101		EVM-38GA00B32
VR102		EVM-38GA00B13
VR103		EVM-38GA00B54
VR201		EVM-38GA00B32
VR202		EVM-38GA00B13
VR203		EVM-38GA00B54
VR301		EVM-38GA00B32
VR302		EVM-38GA00B13
VR303		EVM-38GA00B54
VR401		EVM-38GA00B22
VR402		EVM-38GA00B24
VR403		EVM-38GA00B24
Variable capacitor		
VC101		ECV-1NW10X74B
VC102		ECV-1NW30X74B
VC201		ECV-1NW10X74B
VC202		ECV-1NW30X74B
VC301		ECV-1NW10X74B
VC302		ECV-1NW30X74B

SYMBOL NO.	PART NO.	DESCRIPTION
Inductor		
L101		SA66731-B
L102		SA66731-A
L103		SP0408-6R8K
L104		SP0408-6R8K
L201		SA66731-B
L202		SA66731-A
L203		SP 0408-6R8K
L204		SP0408-6R8K
L301		SA66731-B
L302		SA66731-A
L303		SP0408-6R8K
L304		SP0408-6R8K
L401		SP0408-6R8K
L402		SP0408-6R8K
Connector		
AS1		B3P-SHF-1AA
AS2		B3P-SHF-1AA
AS3		B3P-SHF-1AA
CN101		9815
CN102		9815
CN201		9815
CN202		9815
CN301		9815
CN302		9815
CN401		9815
CN402		9815
VD1		B9P-SHF-1AA

SYMBOL NO.	PART NO.	DESCRIPTION
VI1		BNC-BR-LH
VI2		BNC-BR-LH
VI3		BNC-BR-LH
VI4		BNC-BR-LH
VO1		B5P-SHF-1AA
VP1		B8P-SHF-1AA
Switch		
SW101		AS-12AH
SW201		AS-12AH
SW301		AS-12AH
SW401		AS-12AH
Other Parts		
CN102-CN101		TA56769-B
CN202-CN201		TA56769-C
CN302-CN301		TA56769-A
CN402-CN401		TA56769-B

P.C.B. PARTS LIST MODEL NO.: HM-3719 MODULE NAME: FDF300 (1/4)

SYMBOL NO.	PART NO.	DESCRIPTION
Transistor		
Q 1		2SC1569
Q 2		2SD669AC
Q 3		2SD1175
Q 4		2SB649
Q 5		2SJ79
Q 6		2SD1175
Q 7		2SD1175
Q10		2SD1263AP
Q11		2SD1263AP
Q12		2SD1263AP
Q15		2SD934K
Q16		2SD401AK
IC		
IC1		HD7426P
IC2		HA11235
IC3		μPC451C
Diode		
D 5		A35
D 6		A35
D 7		RC-2
D 8		V09G
D 9		SV-05 (Varistor)
D10		TD-15H
D11		TD-15
D13		V09G
D14		V09G
D15		V09G
D16		V09G
D17		V09G

SYMBOL NO.	PART NO.	DESCRIPTION
*D19		V09G
D20		V09G
D21		V09G
D22		V09G
D23		V09G
D24		V09G
D25		V09G
D26		TD-15H
D29		V09G
D31		V09G
D32		V09G
Zener Diode		
ZD2		HZ30H2
ZD4		HZ30H2
Resistor		

R 1	CF	1/2W, 1 kohm	J
R 2	CF	1/4W, 1 kohm	J
R 3	CF	1/4W, 10 kohm	J
R 7	CF	1/4W, 10 kohm	J
R 8	CF	1/4W, 10 kohm	J
R 9	CF	1/4W, 68 kohm	J
R10	CF	1/4W, 470 ohm	J
R11	CF	1/4W, 470 ohm	J
R12	CF	1/4W, 47 kohm	J
R13	MX	5W, 2.2 kohm	J
R14	CF	1/4W, 3.9 kohm	J
R20	CF	1/4W, 1 kohm	J
R21	MX	3W, 6.8 kohm	J

SYMBOL NO.	PART NO.	DESCRIPTION		
Resistor				
R22		MX	2W, 10 kohm	J
R23		CF	1/4W, 680 kohm	J
R24		CF	1/4W, 1 Mohm	J
R25		CF	1/4W, 5.1 ohm	J
R29		MX	2W, 1.5 kohm	J
R30		CF	1/2W, 2.2 kohm	J
R31		CF	1/2W, 360 kohm	J
R32		CF	1/2W, 360 kohm	J
R33		CF	1/2W, 360 kohm	J
R35		CF	1/4W, 1 Mohm	J
R37		CF	1/2W, 4.7 ohm	J
R38		CF	1/2W, 1 ohm	J
R40		MX	1W, 1 kohm	J
R43		CF	1/4W, 1 kohm	J
*R44		CF	1/4W, 3 kohm	J
R45		CR	1/2W, 2.2 ohm	J
R46		CF	1/2W, 4.7 ohm	J
R49		MX	1W, 3.3 ohm	J
R50		MX	1W, 3.3 ohm	J
R51		CF	1/4W, 2 kohm	J
R52		CF	1/4W, 5.1 kohm	J
R53		CF	1/4W, 8.2 kohm	J
R54		CF	1/4W, 3.9 kohm	J
R55		CF	1/4W, 27 kohm	J
R56		CF	1/4W, 2.7 kohm	J
R57		CF	1/4W, 680 ohm	J
R58		CF	1/4W, 15 kohm	J
R59		CF	1/4W, 10 kohm	J
R60		MF	1W, 2.7 ohm	J
R61		MX	2W, 15 ohm	J
R62		MX	2W, 2.4 kohm	J
R63		MX	2W, 2.4 kohm	J
R64		MX	1W, 10 ohm	J
R65		FR	1W, 1 kohm	K
R66		CF	1/4W, 75 ohm	J
R68		MX	2W, 15 ohm	J
R68		CF	1/2W, 2 kohm	J
R70		MX	2W, 3.3 kohm	J
R72		CF	1/4W, 1 kohm	J
R73		CF	1/4W, 51 kohm	J
R74		CF	1/4W, 5.1 kohm	J
R75		CF	1/4W, 4.7 kohm	J
R76		CF	1/4W, 330 kohm	J
R77		MX	1W, 3.3 kohm	J
R78		CF	1/4W, 100 kohm	J
R79		CF	1/4W, 360 kohm	J
*R80		CF	1/4W, 300 kohm	J
R81		CF	1/4W, 2 kohm	J
R82		CF	1/4W, 1 Mohm	J
R83		CF	1/4W, 1 Mohm	J
*R84		CF	1/4W, 20 kohm	J
R85		CF	1/4W, 15 kohm	J
R86		CF	1/4W, 6.2 kohm	J
R89		CF	1/4W, 5.1 kohm	J
R90		CF	1/4W, 5.1 kohm	J
R91		CF	1/4W, 10 kohm	J
Capacitor				
C 1		PE	50 V, 0.015 μF	K
C 2		PE	50 V, 0.01 μF	K
C 3		AL	25 V, 100 μF	M
C 4		AL	50 V, 1 μF	M
C 5		PE	50 V, 2200 PF	K

SYMBOL NO.	PART NO.	DESCRIPTION		
Capacitor				
C 6		PP	100 V, 2700 PF	J
C 7		CR	500 V, 1000 PF	K
C 8		AL	160 V, 10 µF	Y
C 9		CR	50 V, 0.1 µF	M
C13		PE	250 V, 0.1 µF	K
C15		AL	160 V, 100 µF	Y
C16		PP	2500 V, 1000 PF	J
C17		CR	500 V, 470 PF	K
C19		AL	16 V, 100 µF	M
C22		PP	1600V, 0.022µF	J
C23		AL	250 V, 10 µF	Y
C24		PE	250 V, 0.1 µF	K
C26		AL	450 V, 2.2 µF	Y
C27		AL	160 V, 47 µF	Y
C28		AL	25 V, 100 µF	M
C29		AL	160 V, 100 µF	Y
C31		PE	250 V, 0.47 µF	K
C32		PE	250 V, 0.33 µF	K
C35		PP	2500V, 3900PF	J
C36		PP	2500V, 4700PF	J
C40		AL	63 V, 100µF	M
C42		AL	50 V, 1 µF	M
C43		AL	16 V, 1000 µF	M
C44		AL	25 V, 100 µF	M
C45		CR	500 V, 300 PF	K
C46		AL	50 V, 1 µF	M

SYMBOL NO.	PART NO.	DESCRIPTION		
C48		PE	50 V, 0.01 µF	K
C49		CR	50 V, 1000 PF	K
C50		PE	50 V, 1 µF	J
C51		CR	50 V, 150 PF	K
C52		PE	50 V, 1000 PF	K
C53		AL	50 V, 22 µF	M
C54		AL	100 V, 220 µF	M
C55		CR	500 V, 0.01 µF	K
C57		PE	250 V, 47 µF	K
C58		AL	160 V, 47 µF	Y
C59		AL	100 V, 22 µF	M
C61		CR	50 V, 0.1 µF	M
C63		AL	10 V, 100 µF	M
C64		PE	250 V, 1 µF	K
C65		CR	50 V, 470 PF	K
C66		TA	35 V, 1 µF	M
C67		PE	50 V, 0.33 µF	K
C69		PE	250 V, 0.1 µF	K
C70		PE	50 V, 1 µF	J
C71		PE	50 V, 1 µF	J
C72		CR	50 V, 0.1 µF	M
C75		CR	500 V, 470 PF	K
C76		PE	250 V, 4.7 µF	K
C78		CR	50 V, 0.1 µF	M
C79		CR	50 V, 1500 PF	K

SYMBOL NO.	PART NO.	DESCRIPTION
Variable Resistor		
VR 2		EVM-38GA00B53
*VR 3		EVM-38GA00B55
*VR 4		EVM-38GA00B24
VR 6		WR188KPVB50 ohm
VR 8		EVM-38GA00B53
VR 9		EVM-38GA00B52
VR10		EVM-81U10KB54
VR12		EVM-38GA00B53
VR13		EVM-38GA00B53
VR14		EVM-38GA00B14
VR15		EVM-38GA00B15
Ind		
Inductor		
L 1		SN-8S-400
L 2		LT-L4.7M
L 3		4P-31244
L 5		HL2631C-51
L 7		SP0408-6R8K
L 8		CH3011A
L10		SP0408-6R8K
L11		B-20F-38 (EMC bead)
L12		B-20F-38 (EMC bead)
Transistor		
T 1		TR2009
*T 2		MSH1RAD108 (FBT)
T 3		TR4036

SYMBOL NO.	PART NO.	DESCRIPTION
Connector		
DJ1		3P-SVF (housing)
DJ1		RTB-1.5-3F
DP1		B8P-SHF-1AA
DS1		B4P-SHF-1AA
DS2		B4P-SHF-1AA
DS3		RTB-1.5-2F
DV1		B9P-SHF-1AA
DY1		RTB-1.5-4F
DY2		RTB-1.5-3F
PD2		3P-SVF
Other parts		
Varistor		
SGA1		ERZ-15D3K681
Thermistor		
*TH2		ERT-D2FHL332S

P.C.B. PARTS LIST MODEL NO.: HM-3719 MODULE NAME: FCS200 (1/1)

SYMBOL NO.	PART NO.	DESCRIPTION		
Resistor				
R1		MX	1/2W, 1 kohm	J
R2		CF	1/2W, 1 Mohm	J
R3		CF	1/2W, 100 kohm	J
Capacitor				
C1		CR	2 kV, 2000 PF	K
Variable Resistor				
VR1		EVT-J6US15B16		
Socket				
S1		S-B0895		
Neon Tube				
NE1		SGA-5-C		
NE2		SGA-5-C		
NE3		SGA-5-C		
Connector				
SA1		BS3P-SHF-1AA		
SA2		BS3P-SHF-1AA		
SA3		BS3P-SHF-1AA		
SD1		B4P-SHF-1AA		
SD2		B4P-SHF-1AA		
SD3		RTB-1.5-2F		

SYMBOL NO.	PART NO.	DESCRIPTION

P.C.B. PARTS LIST MODEL NO.: HM-3719 MODULE NAME: FPS300 (1/

SYMBOL NO.	PART NO.	DESCRIPTION
Transistor		
Q1		2SC3412
Q2		2SC1318R
Q3		2SA673AKC
Q4		2SC2545E
Q5		2SC1162C
Q6		2SA673AKC
Q7		2SD401AK
Q8		2SC1162C
Q11		2SD401AK
IC		
IC11		HA17812P
IC12		HA17805P
Diode		
D1		S5VB60
D2		A-35
D3		U07M
D5		A-35
D6		A-35
D7		EH-1Z
D8		A-35
D9		A-35
D11		30JG2C11
D13		A-35
D14		A-35
D15		S5KC20
D16		V06C

SYMBOL NO.	PART NO.	DESCRIPTION			
Zener Diode					
ZD1		HZ11 Ⓗ B1			
ZD2		HZ6-B1			
ZD3		HZ18-2			
ZD4		HZ33L-3			
ZD11		HZ6LC2			
Resistor					
R 1		FR	5W, 10 ohm	J	
R 2		CF	1/4W, 1 kohm	J	
R 3		MX	2W, 200 ohm	J	
R 4		MX	5W, 51 kohm	J	
R 5		MX	2W, 82 kohm	J	
R 6		MX	2W, 82 kohm	J	
R 7		MX	5W, 68 kohm	J	
R 8		MX	3W, 30 ohm	J	
R 9		MX	3W, 30 ohm	J	
R10		MF	3W, 0.47 ohm	J	
R11		CF	1/4W, 750 ohm	J	
R12		CF	1/4W, 820 ohm	J	
R13		CF	1/4W, 30 kohm	J	
R14		CF	1/4W, 1.6 kohm	J	
R15		CF	1/4W, 10 kohm	J	
R16		CF	1/4W, 10 ohm	J	
R17		CF	1/4W, 1 kohm	J	
R18		CF	1/4W, 510 ohm	J	
R19		CF	1/4W, 200 ohm	J	
R20		CF	1/4W, 100 ohm	J	
R21		CF	1/2W, 4.7 ohm	J	
R22		CF	1/2W, 47 ohm	J	
R23		MX	1W, 300 ohm	J	
R24		CF	1/4W, 2 kohm	J	
R25		CF	1/4W, 22 ohm	J	
R26		CF	1/4W, 36 kohm	J	
R27		CF	1/4W, 5.1 kohm	J	

SYMBOL NO.	PART NO.	DESCRIPTION		
Resistor				
R28		CF	1/4W, 2 kohm	J
R29		CF	1/4W, 10 ohm	J
R31		WW	7W, 51 ohm	J
R32		WW	7W, 51 ohm	J
R33		CF	1/2W, 47 kohm	J
R34		CF	1/4W, 2 kohm	J
R35		MX	1/2W, 10 kohm	J
R36		CF	1/4W, 5.1 kohm	J
R37		CF	1/4W, 1 kohm	J
Capacitor				
C 1		CR	2 KV, 1000 PF	Z
C 2		CR	2 KV, 1000 PF	Z
C 4		AL	250 V, 680 µF	X
C 5		AL	250 V, 680 µF	X
C 6		PP	1000V, 0.047µF	K
C 7		PE	50 V, 0.1 µF	K
C 8		PE	50 V, 0.01 µF	K
C 9		PE	50 V, 0.1 µF	K
C10		AL	35 V, 100 µF	M
C11		AL	16 V, 10 µF	M
C12		PE	50 V, 0.47 µF	K
C14		PE	50 V, 0.22 µF	K
C15		PE	250 V, 0.47 µF	M
C16		PE	50 V, 0.1 µF	K
C17		AL	63 V, 100 µF	M
C18		AL	63 V, 100 µF	M
C19		PE	50 V, 0.022 µF	K
C20		PE	50 V, 4700 PF	K
C21		CR	2 KV, 2200 PF	K
C22		CR	2 KV, 2200 PF	K

SYMBOL NO.	PART NO.	DESCRIPTION		
C24		AL	160 V, 470 µF	Y
C25		AL	160 V, 100 µF	Y
C26		AL	16 V, 47 µF	M
C28		AL	25 V, 2200 µF	M
C29		PE	50 V, 0.1 µF	K
C30		AL	25 V, 470 µF	M
C31		AL	25 V, 470 µF	M
C33		AL	10 V, 220 µF	M
C34		CR	500 V, 1000 PF	K
C35		CR	2 KV, 220 PF	K
C37		PE	50 V, 0.1 µF	K
Thermister				
TH1		ERT-D2FHL332S		
Photo Coupler				
PC		PC827		
Traiac				
SCR1		FSM10B4		
Spark Killer				
SK1		XE-1201		
Transformer				
T1		TR6006		

SYMBOL NO.	PART NO.	DESCRIPTION
Coil		
L1		SC-05-100
Resistor		
RP1		ERP-F5B0M080F
RP2		ERP-F5B0N180G
Check Terminal		
CH1		#226
CH2		#226
Connector		
PD1		B8P-SHF-1AA
PD2		RTB-1.5-3
PG1		RTB-1.5-2
PP2		RTB-1.5-5
PP3		3P-SVF
PP3-1		RTB-1.5-3
PP3-2		RTB-1.5-3
PV1		B8P-SHF-1AA
Variable Resistor		
VR1		EVM38GA00B23, 2 kohm

SYMBOL NO.	PART NO.	DESCRIPTION

APPENDIX III

EXPLODED VIEWS OF MECHANICAL PARTS

1. MECHANICAL PARTS LIST

ITEM NO.	REF. DESIGNATION	DESCRIPTION	Q'TY
1	①	CATHODE RAY TUBE	1
2	②	FLAME	1
3	③	COVER	1
4	④	FITTING	1
5	⑤	SUPPORT PANEL (RIGHT) } NOTE 1.	1
6	⑥	SUPPORT PANEL (LEFT)	
7			
8			
9			
10			
11	⑪	VIDEO AMPLIFIER ASSEMBLY (FVD300)	1
12	⑫	DEFLECTION ASSEMBLY (FDF300)	1
13	⑬	POWER SUPPLY ASSEMBLY (SG-2W80)	1
14	⑭	SOCKET BOARD (FCS200)	1

NOTE 1. These parts are fitted to FLAME ① by rivets.

2. DRAWINGS

SEE FIG. III-1 ∿ 2.

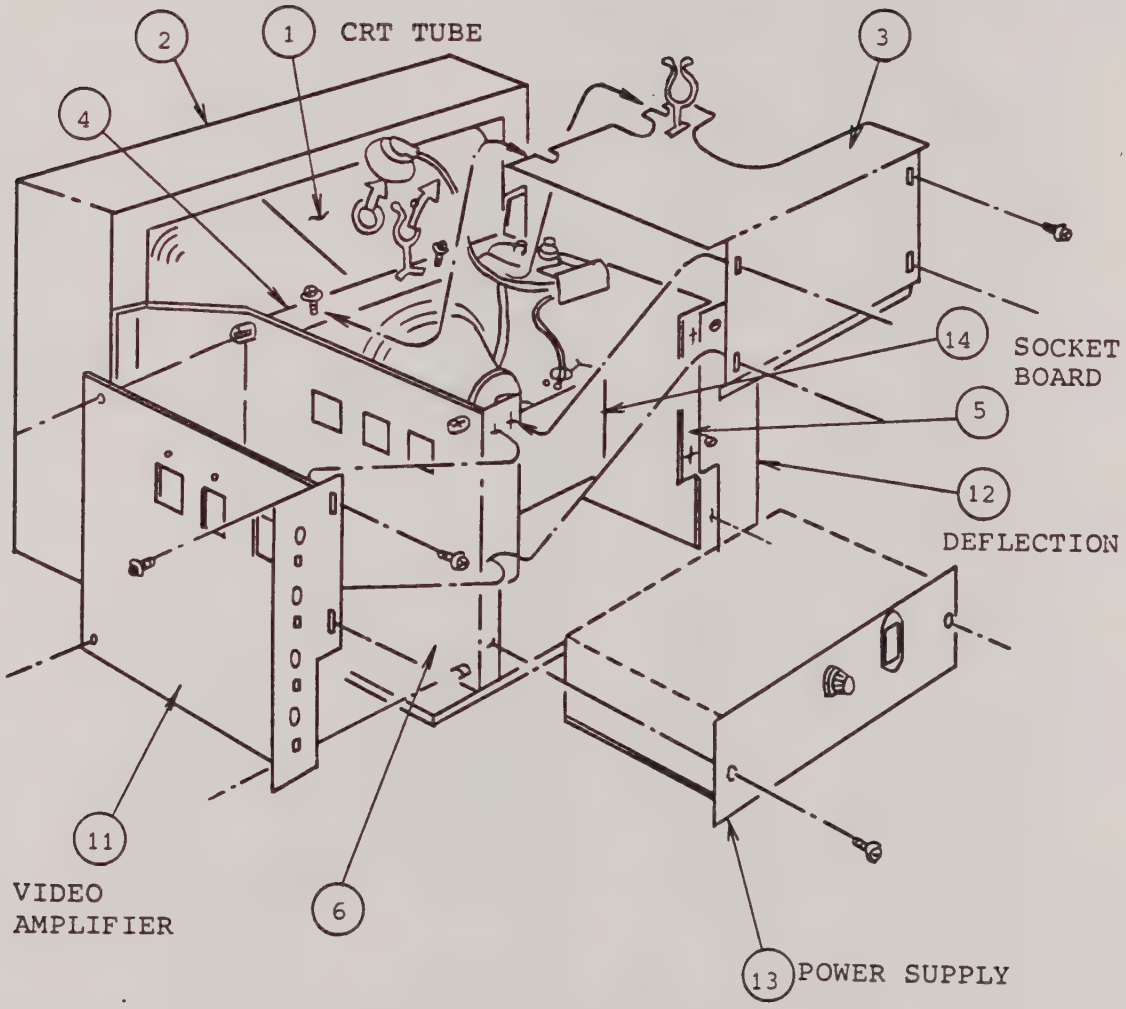

2
1
CRT TUBE
3
4
14
SOCKET
BOARD
5
12
DEFLECTION
11
VIDEO
AMPLIFIER
6
13
POWER SUPPLY

FIG. III-1

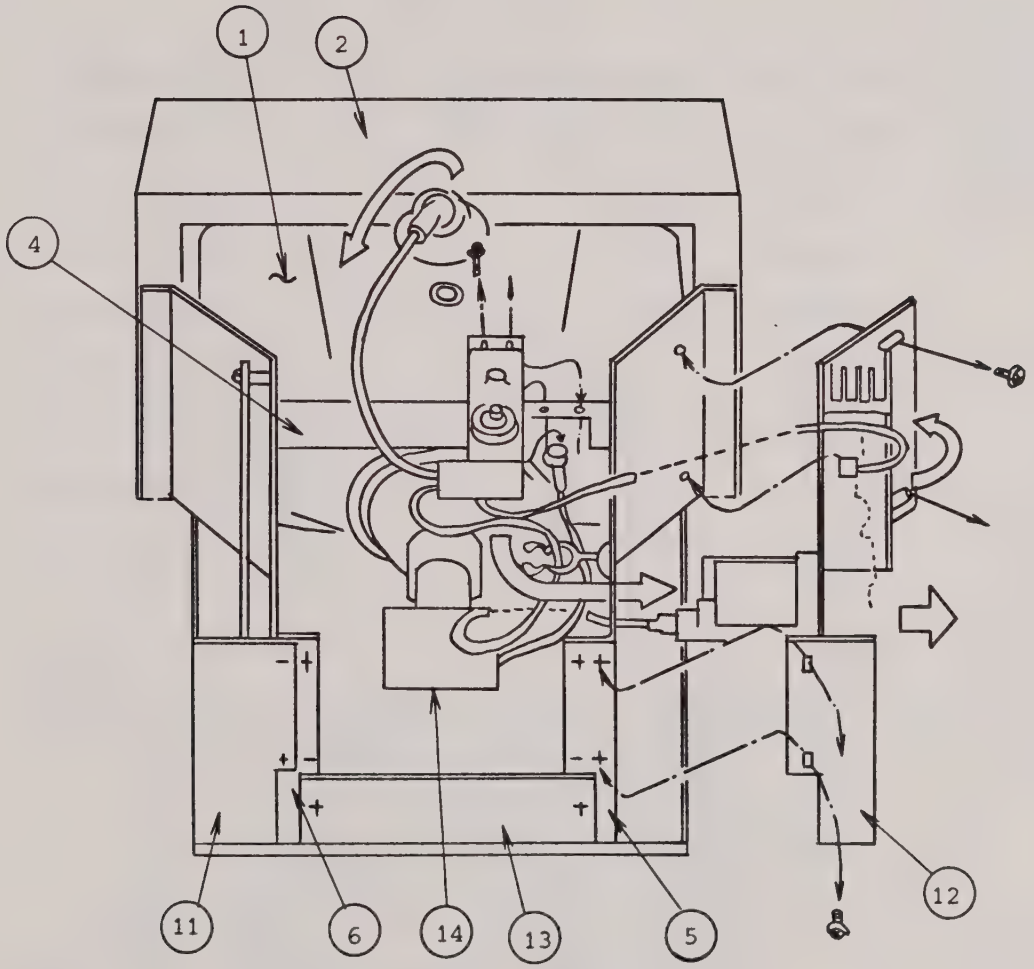


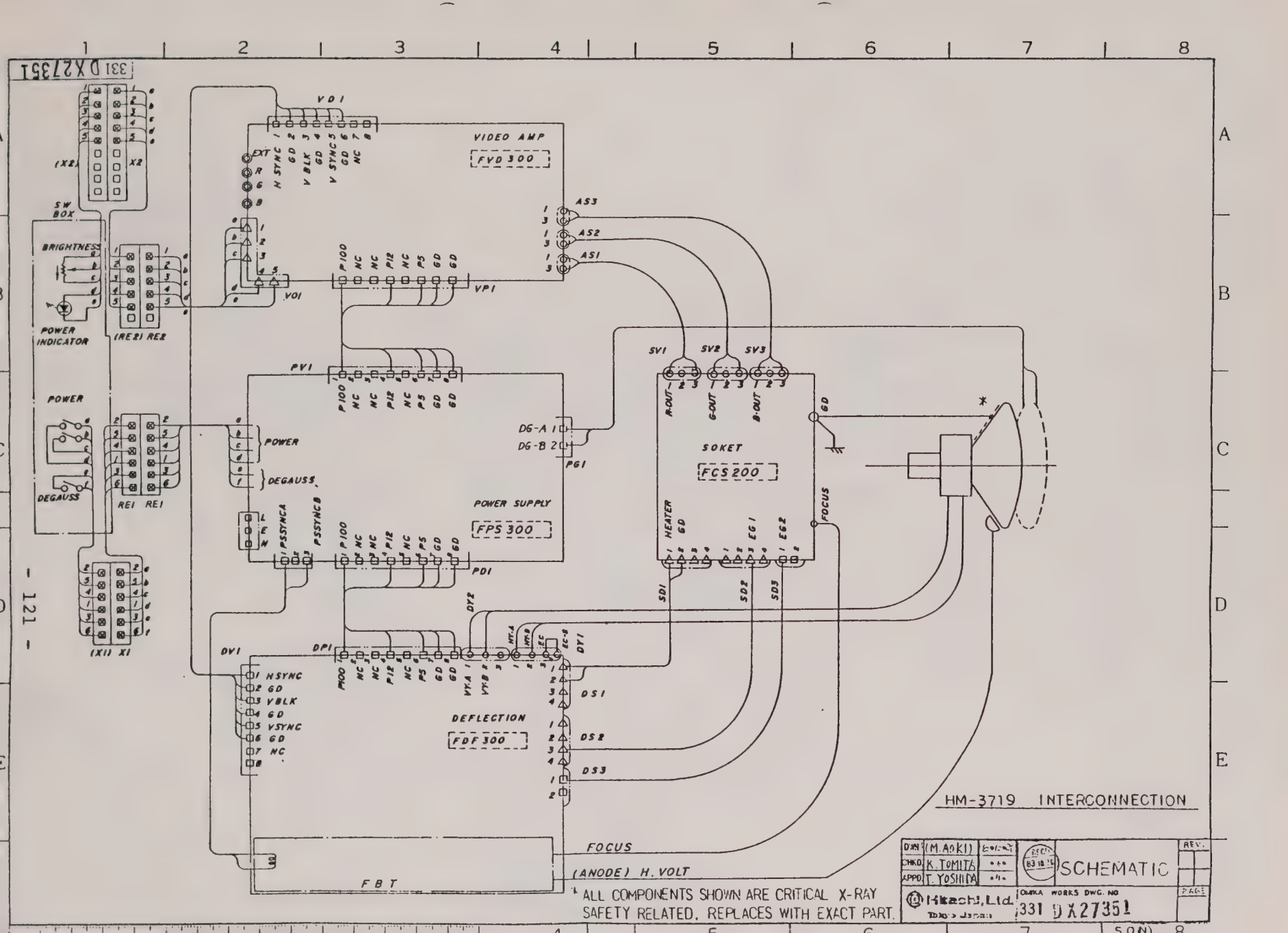
FIG. III-2

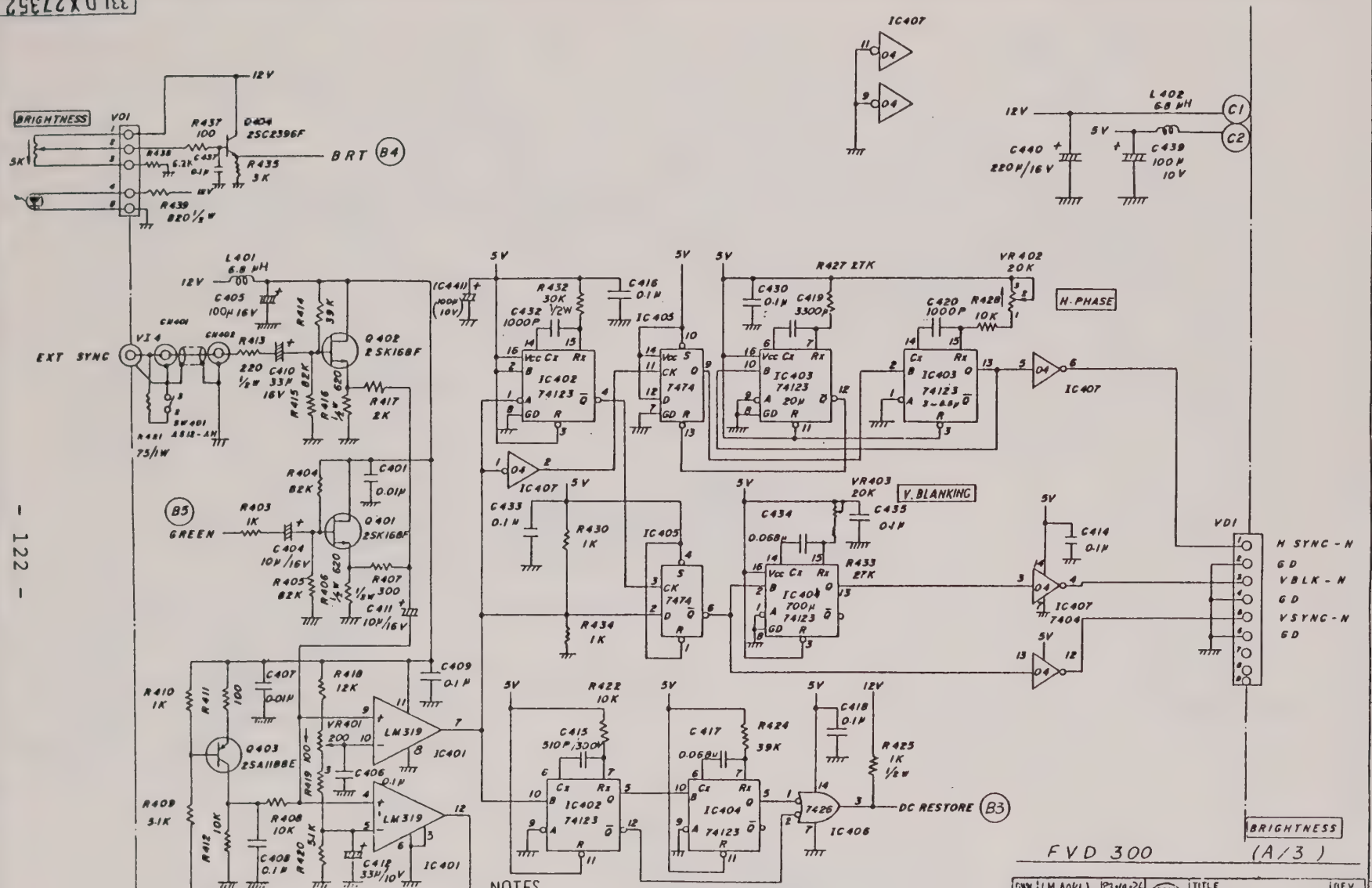
APPENDIX IV

SCHEMATICS

HM-3719	INTERCONNECTION	..... 331DX27351
FVD300	(A/3)	..... 331DX27352
FVD300	(B/3)	..... 331DX27353
FVD300	(C/3)	..... 331DX27354
FCS200	(A/1)	..... 331DX28317
FDF300	(A/3)	..... 331DX27355
FDF300	(B/3)	..... 331DX27356
FDF300	(C/3)	..... 331DX27357
FPS300	(SG-2W80) (A/1)	..... 331DX27358

NOTES 1 : WATTAGE UNDEFINED RESISTORS ARE 1/4W.
2 : VOLTAGE UNDEFINED CAPACITORS ARE 50 V.
3 : RESISTANCE VALUES ARE IN OHMS.
4 : CAPACITANCE VALUES ARE IN FARADS.
5 : NOT MOUNTING DEVICES SHOWED "( )".
6 : COMPONENTS MARKED WITH "*" HAVE SPECIAL CHARACTERISTICS IMPORTANT TO SAFETY. BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE PRODUCT SAFETY NOTICE OF THIS MANUAL. DON'T DEGRADE THE SAFETY OF THE COLOR MONITOR THROUGH IMPROPER SERVICING.

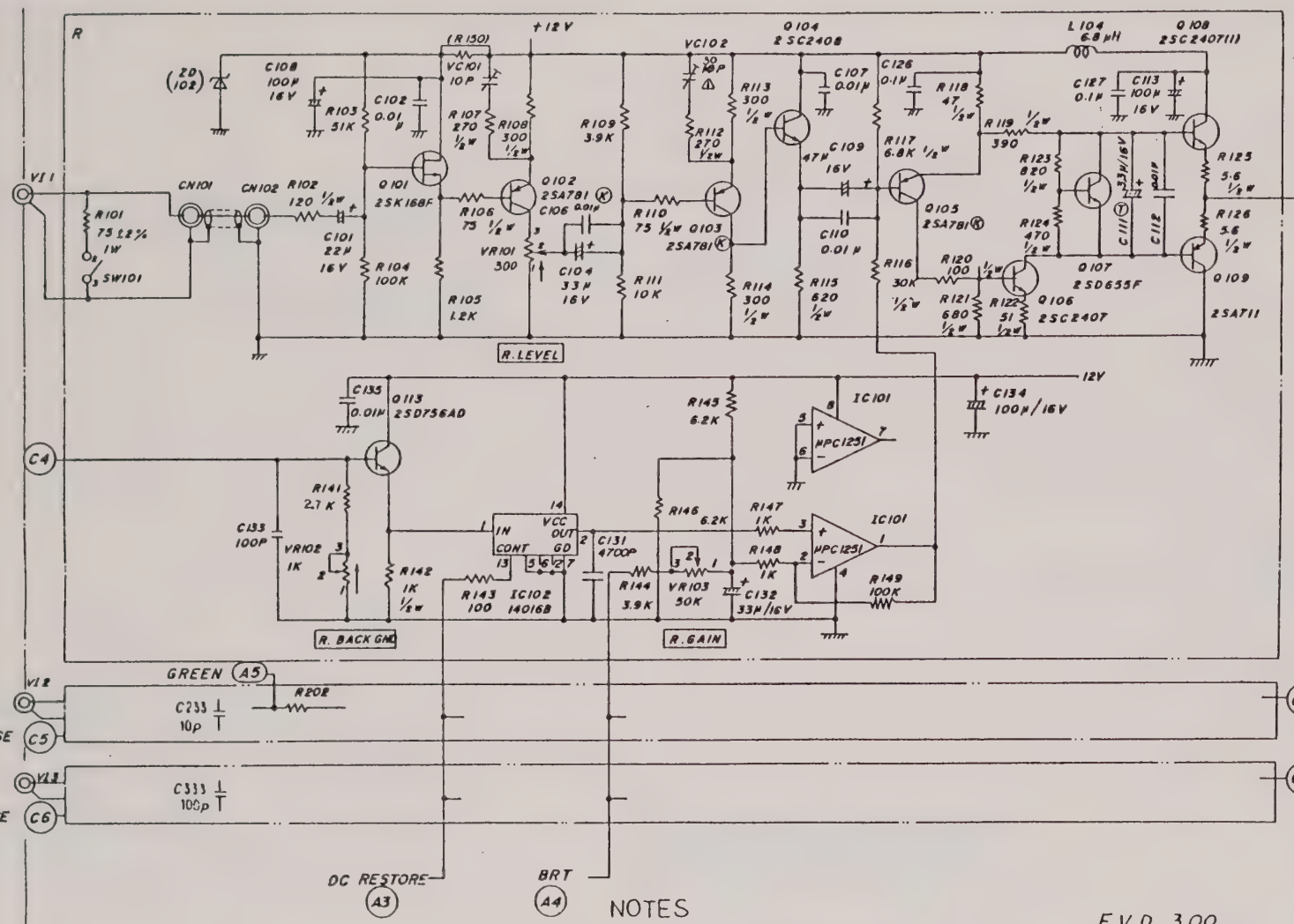

331 DX27351
VIDEO AMP
FVD 300
VD1
VO1
VP1
AS3
AS2
AS1
SW BOX
BRIGHTNESS
POWER INDICATOR
(RE2) RE2
POWER
DEGAUSS
RE1
(X1) X1
(X2) X2
PV1
PDI
POWER SUPPLY
FPS 300
DG-A 1
DG-B 2
PG1
SV1
SV2
SV3
SOKET
FCS 200
SD1
SD2
SD3
DY2
DY1
DP1
DS1
DS2
DS3
DV1
DEFLECTION
FDF 300
FBT
FOCUS
(ANODE) H. VOLT
HM-3719 INTERCONNECTION
* ALL COMPONENTS SHOWN ARE CRITICAL X-RAY SAFETY RELATED, REPLACES WITH EXACT PART.
DWN (M.AOKI)
CHKD K.TOMITA
APPD T.YOSHIDA
SCHEMATIC
Hitachi, Ltd.
OMURA WORKS DWG. NO
331 DX27351
REV.
PAGE
- 121 -



NOTES
1 WATTAGE UNDEFINED RESISTORS ARE 1/4 W
2 VOLTAGE UNDEFINED CAPACITORS ARE 50V
3 RESISTANCE VALUES ARE IN OHMS (Ω)
4 CAPACITANCE VALUES ARE IN FARADS (F)
5 NOT MOUNTING DEVICES SHOWED ( )

FVD 300 (A/3)

DWN.	M. AOKI	83-10-26	REGD	TITLE: SCHEMATIC
CKD.	K. TOMITA	...		REV.
APPD.	T. YOSHIDA	...		
Hitachi, Ltd. Tokyo Japan				DRAWING NUMBER: 331 DK27352 PAGE



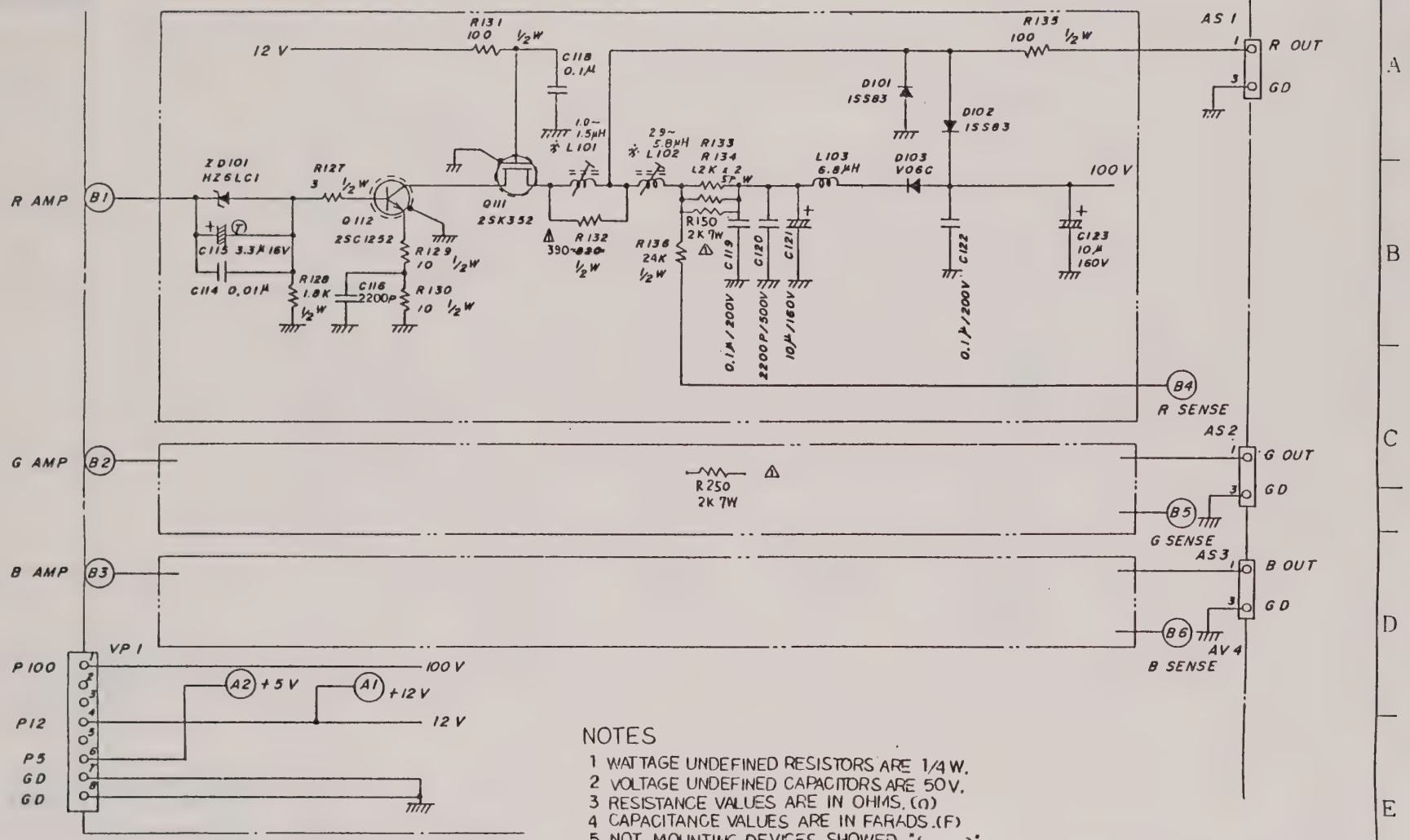
NOTES

1 WATTAGE UNDEFINED RESISTORS ARE 1/4 W.
2 VOLTAGE UNDEFINED CAPACITORS ARE 50V.
3 RESISTANCE VALUES ARE IN OHMS. (Ω)
4 CAPACITANCE VALUES ARE IN FARADS. (F)
5 NOT MOUNTING DEVICES SHOWED "( )"

FVD 300 (B/3)

DWN.	(M.AOKI)	'85-10-26	TITLE	REV.
CHK'D	K.TOMITA	...	SCHEMATIC	
APPD	T.YOSHIDA	...		
Hitachi, Ltd. Tokyo, Japan			OMIKA WORKS DWG. NO. 331DX27353	

⚠ CHANGED CAPACITOR VC102, VC202, VC302 '86-1-18 M.Ooki REV.A



NOTES

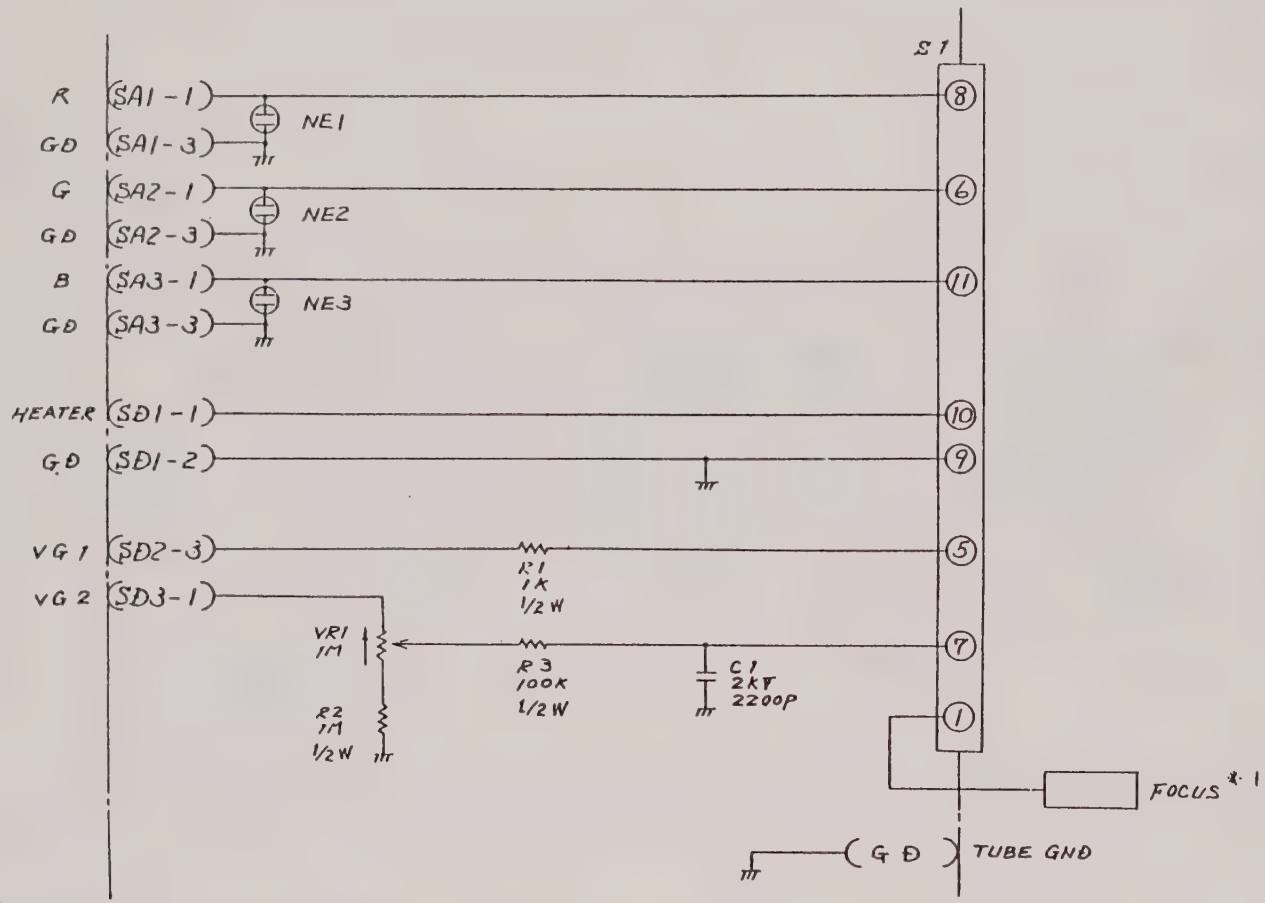
1 WATTAGE UNDEFINED RESISTORS ARE 1/4 W.
2 VOLTAGE UNDEFINED CAPACITORS ARE 50 V.
3 RESISTANCE VALUES ARE IN OHMS. (Ω)
4 CAPACITANCE VALUES ARE IN FARADS. (F)
5 NOT MOUNTING DEVICES SHOWED "( ):"

FVD 300 (C/3)

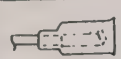
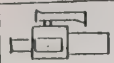
DWN.	M. ACKI	83-10-26	TITLE	REV.
CHK'D	K. TOMITA		SCHEMATIC	
APP'D	T. YOSHIDA			
Hitachi, Ltd. Tokyo Japan			OMIRA WORK'S DWG. NO. 331 DX27354	PAGE

Δ ADDED RESISTOR R150 R250)
Δ CHANGED RESISTOR R132 R232 83-12-16 REV A

⚠ ADDED NOTE 84·2·15 M. Ami



⚠ *1 NOTE

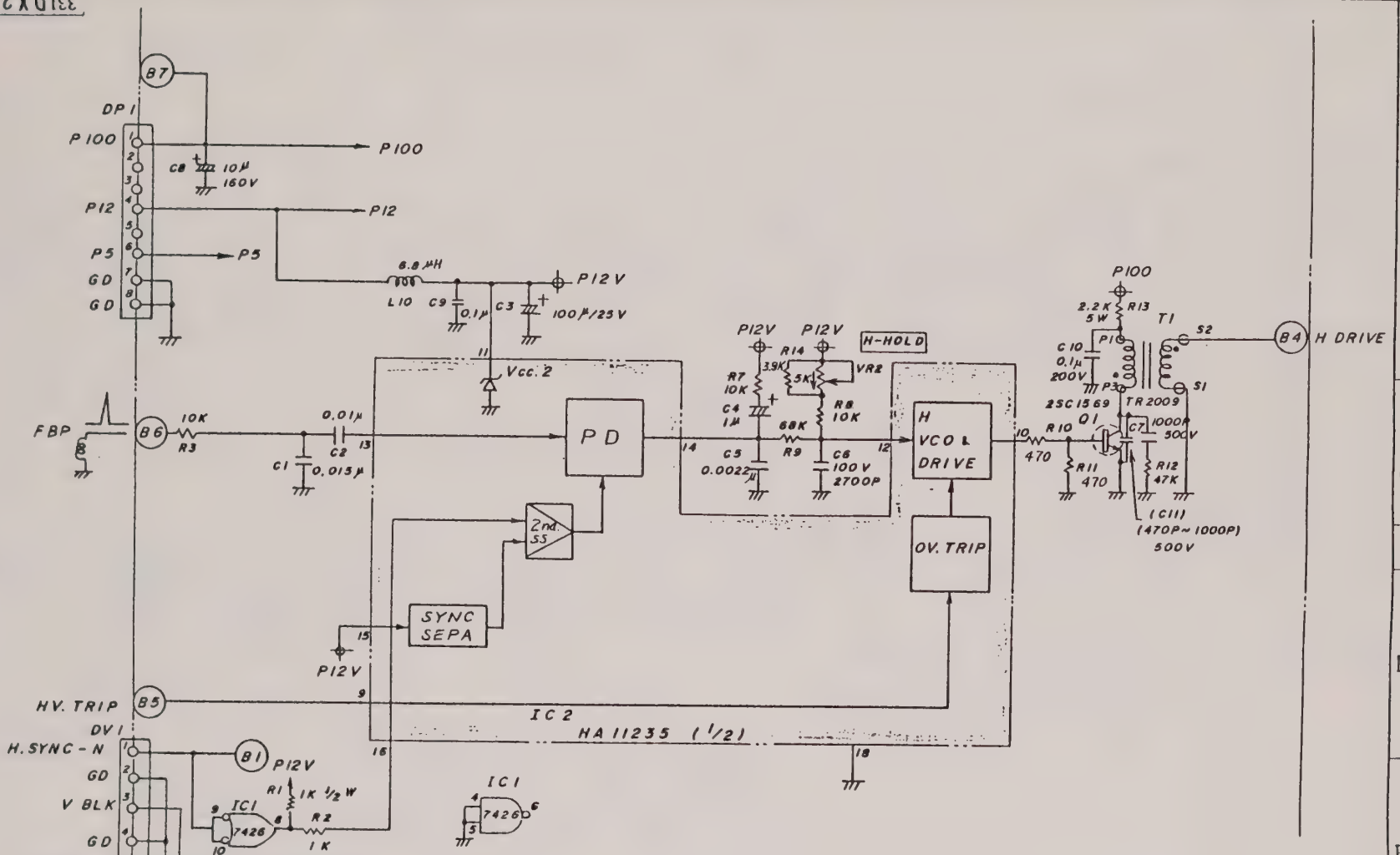
TYPE I	TYPE II
	

FOCUS BOARD FCS 20X TABLE

FOCUS BOARD	MONITOR TYPE	CONNECTOR
FCS 200	HM-3719	TYPE I
FCS 201	HM-4619	TYPE II

FCS 20X (A/1)

DWN	K. Yamaoka	83-9-18	TITLE: SCHEMATIC
CHKD	K. Yamaoka		REV.
APPD	K. Onuma		
Hitachi, Ltd. Tokyo Japan			OMIKA WORKS DWG. NO. 331 DX28317
			PAGE



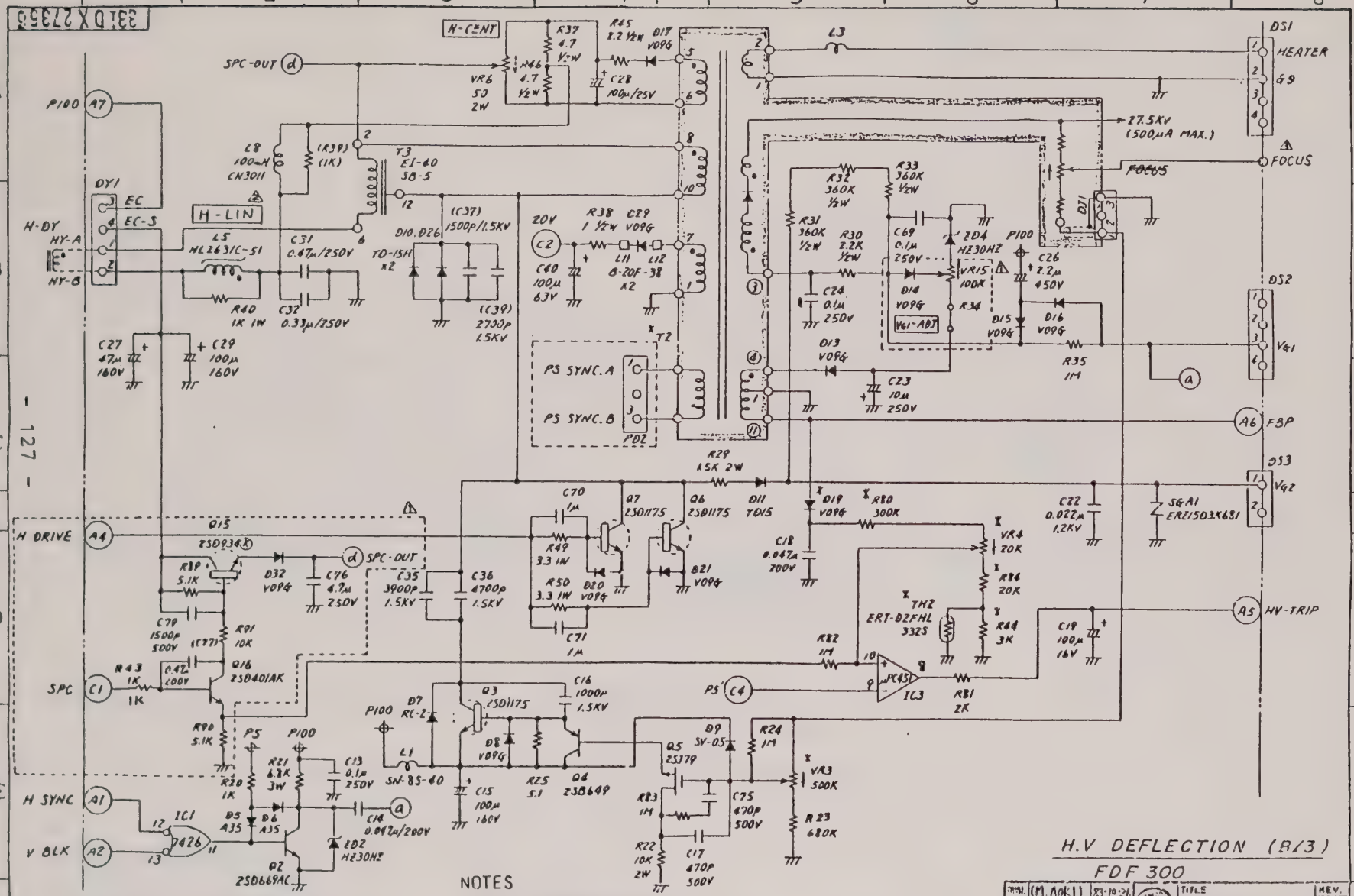
NOTES

1 WATTAGE UNDEFINED RESISTORS ARE 1/4 W.
2 VOLTAGE UNDEFINED CAPACITORS ARE 50V.
3 RESISTANCE VALUES ARE IN OHMS. (Ω)
4 CAPACITANCE VALUES ARE IN FARADS.(F)
5 NOT MOUNTING DEVICES SHOWED "( )"

H DEF CONTROLL (A/3)

FDF 300

DWN	(M. Aoki)	12-Nov-76	TITLE: SCHEMATIC
CHK'D	k. TOMITA	" "	REV.
APP'D	T. YOSHIDA	" "	
Hitachi, Ltd. Tokyo Japan			DWG. NO. 331DX27355 PAGE



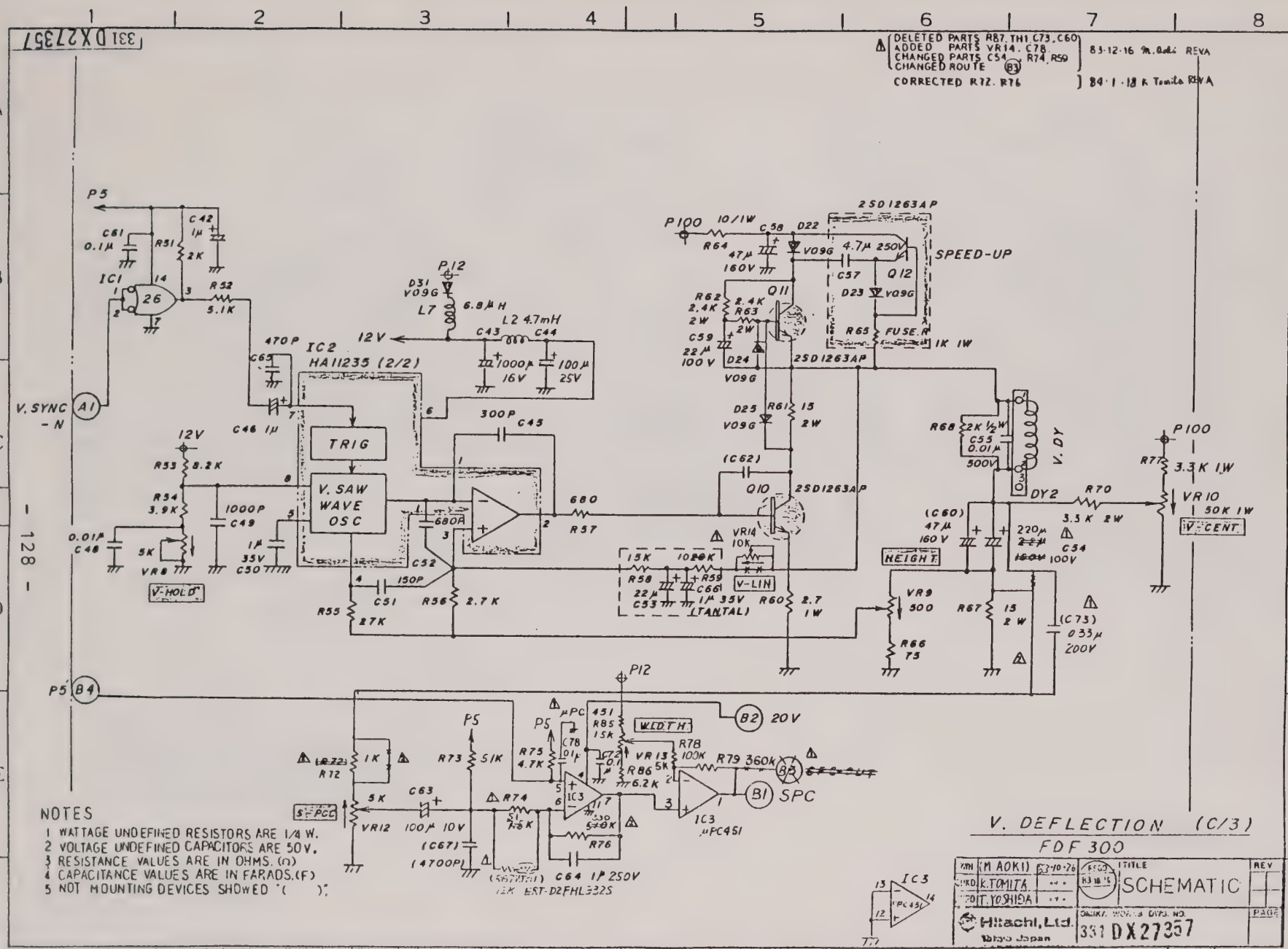
NOTES

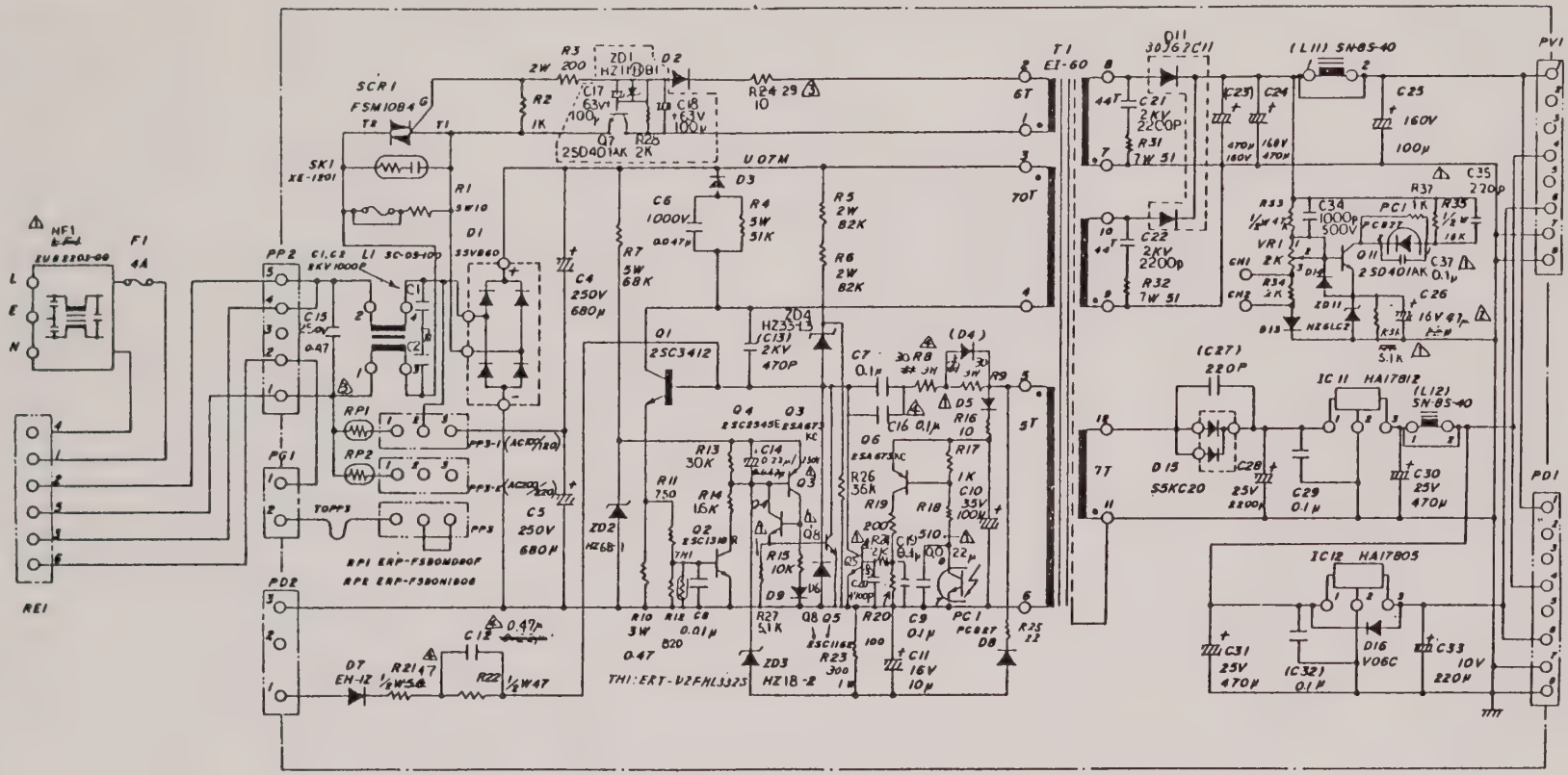
1 WATTAGE UNDEFINED RESISTORS ARE 1/4 W
2 VOLTAGE UNDEFINED CAPACITORS ARE 50 V
3 RESISTANCE VALUES ARE IN OHMS (Ω)
4 CAPACITANCE VALUES ARE IN FARADS (F)
5 NOT MOUNTING DEVICES SHOWED "( )"

* ALL COMPONENTS SHOWN ARE CRITICAL X-RAY SAFETY RELATED REPLACES WITH EXACT PART.

⚠ CORRECTED 84-2-15 M. Aoki
⚠ ADDED 84-1-18 K. Sasaki, K. TOMITA
⚠ REVISED CIRCUIT 83-12-16 M. Aoki REV A

DRN. (M. AOKI) 83-10-26
CHKD K. TOMITA
APPD T. YOSHIDA


331DX27357
DELETED PARTS RB7, TH1, C73, C60
ADDED PARTS VR14, C78
CHANGED PARTS C54, R74, R59
CHANGED ROUTE (B3)
CORRECTED R72, R76
83-12-16 M. Aoki REV A
84-1-18 K. Tomita REV A
P5
C81 0.1μ
R51 2K
C42 1μ
IC1 26
R52 5.1K
P12
D31 V09G
L7 6.8μH
L2 4.7mH
C43
C44
1000μ 16V
100μ 25V
12V
470P
C62
IC2 HA11235 (2/2)
V. SYNC -N
A1
C46 1μ
TRIG
V. SAW WAVE OSC
300P C45
680
R57
680A
C52
150P
C51
R56 2.7K
R55 2.7K
R53 8.2K
R54 3.9K
1000P C49
0.01μ C48
5K VR8
V-HOLD
1μ 35V C50
P100
10/1W
R64 47μ 160V
C58
D22
V09G
2SD1263AP
4.7μ 250V
SPEED-UP
C57
Q12
D23 V09G
Q11
R62 2.4K 2W
R63 2.4K 2W
C59 22μ 100V
D24 V09G
R65 FUSE.R 1K 1W
2SD1263AP
D25 V09G
R61 15 2W
(C62)
Q10 2SD1263AP
VR14 10K
15K
1020K
R58
R59
22μ C53
C66 1μ 35V (TANTAL)
V-LIN
R60 2.7 1W
R68 2K ½W
C55 0.01μ 500V
V. DY
DY2
R70 3.3K 2W
(C60) 47μ 160V
220μ
C54 100V
HEIGHT
VR9 500
R67 15 2W
R66 75
(C73) 033μ 200V
P100
R71 3.3K 1W
VR10 50K 1W
V-CENT
P5 B4
P12
μPC
451
R85 15K
WIDTH
B2 20V
R78 100K
R79 360K
B3
VR13 5K
R86 6.2K
B1 SPC
IC3 μPC451
R72 1K
R73 51K
R75 4.7K
C78 01μ
C72 0.1μ
C63
R74
51 1/8K
330 1/8K
R76
VR12 5K
S-PCC
100μ 10V
(C67) (4700P)
C64 1μ 250V
(2K EST-D2FHL332S)
NOTES
1 WATTAGE UNDEFINED RESISTORS ARE 1/4 W.
2 VOLTAGE UNDEFINED CAPACITORS ARE 50V.
3 RESISTANCE VALUES ARE IN OHMS. (Ω)
4 CAPACITANCE VALUES ARE IN FARADS.(F)
5 NOT MOUNTING DEVICES SHOWED "( )".
V. DEFLECTION (C/3)
FDF 300
DRN (M AOKI) 83-10-26
DSGD K. TOMITA
EDIT T. YOSHIDA
SCHEMATIC
REV
Hitachi, Ltd. Tokyo Japan
331 DX27357
PAGE
- 128 -



NOTES

1 WATTAGE UNDEFINED RESISTORS ARE 1/4W.
2 VOLTAGE UNDEFINED CAPACITORS ARE 50V.
3 RESISTANCE VALUES ARE IN OHMS. (Ω)
4 CAPACITANCE VALUES ARE IN FARADS.(F)
5 NOT MOUNTING DEVICES SHOWED "( )".

FPS 300 (SG-2W80)

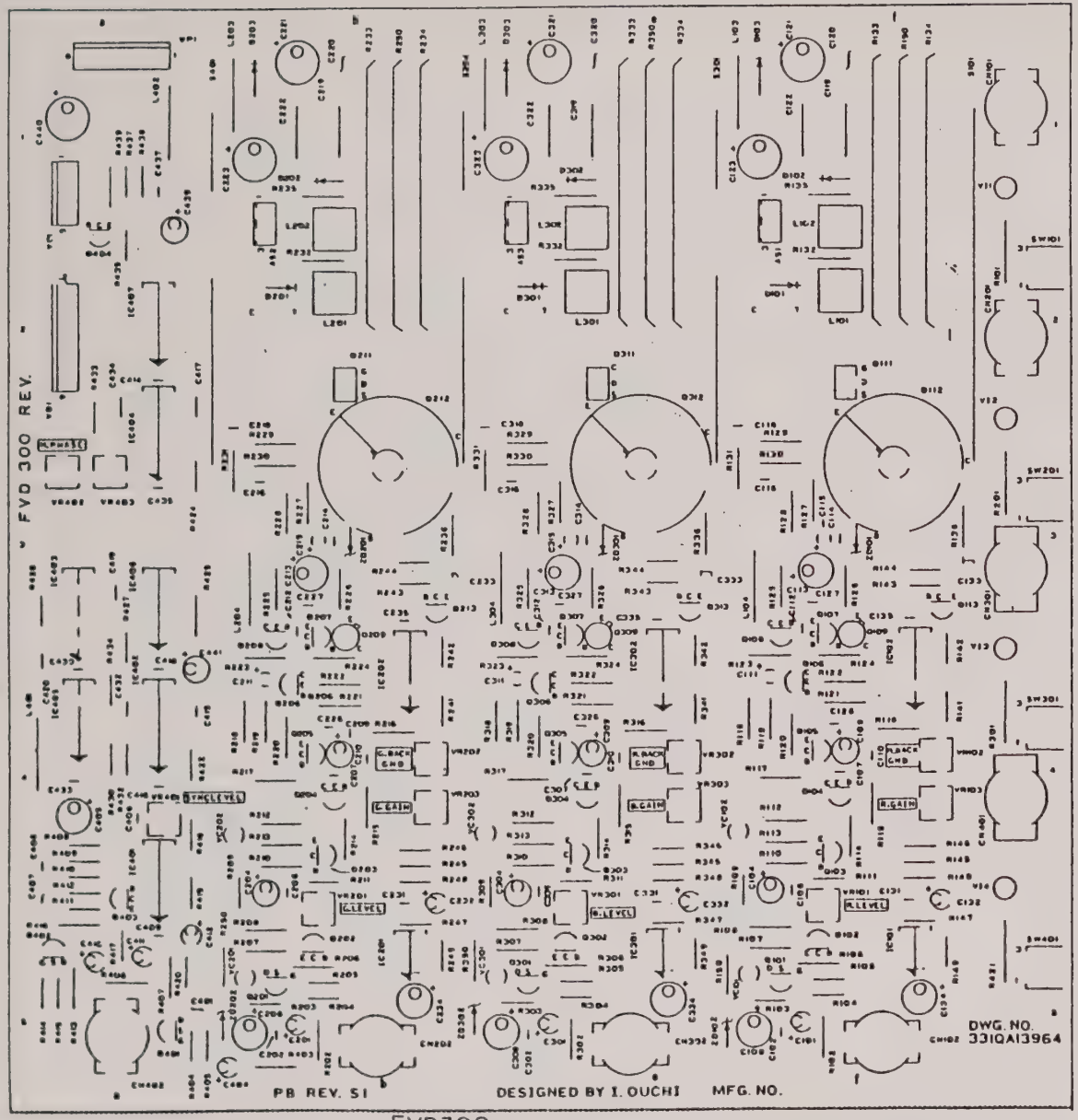
DWN.	(M.AOKI)	83-10-26	TITLE	REV.
CHKD	K.TOMITA	〃	SCHEMATIC	
APPD	T.YOSHIDA	〃		
Hitachi, Ltd. Tokyo Japan			OHMIKA WORKS DWG NO. 331DX27358	PAGE

⚠ REVISED CIRCUIT 84-4-16 K. Sasaki REV.C
⚠ REVISED CIRCUIT 84-4-16 K. Sasaki REV.B
⚠ CORRECTED "○" "R24 → R29" 84-1-30 A. Watanabe
⚠ CORRECTED C28 84-1-18 K. Tomita REV.A
⚠ REVISED CIRCUIT 83-12-16 M. Aoki REV.A

APPENDIX V

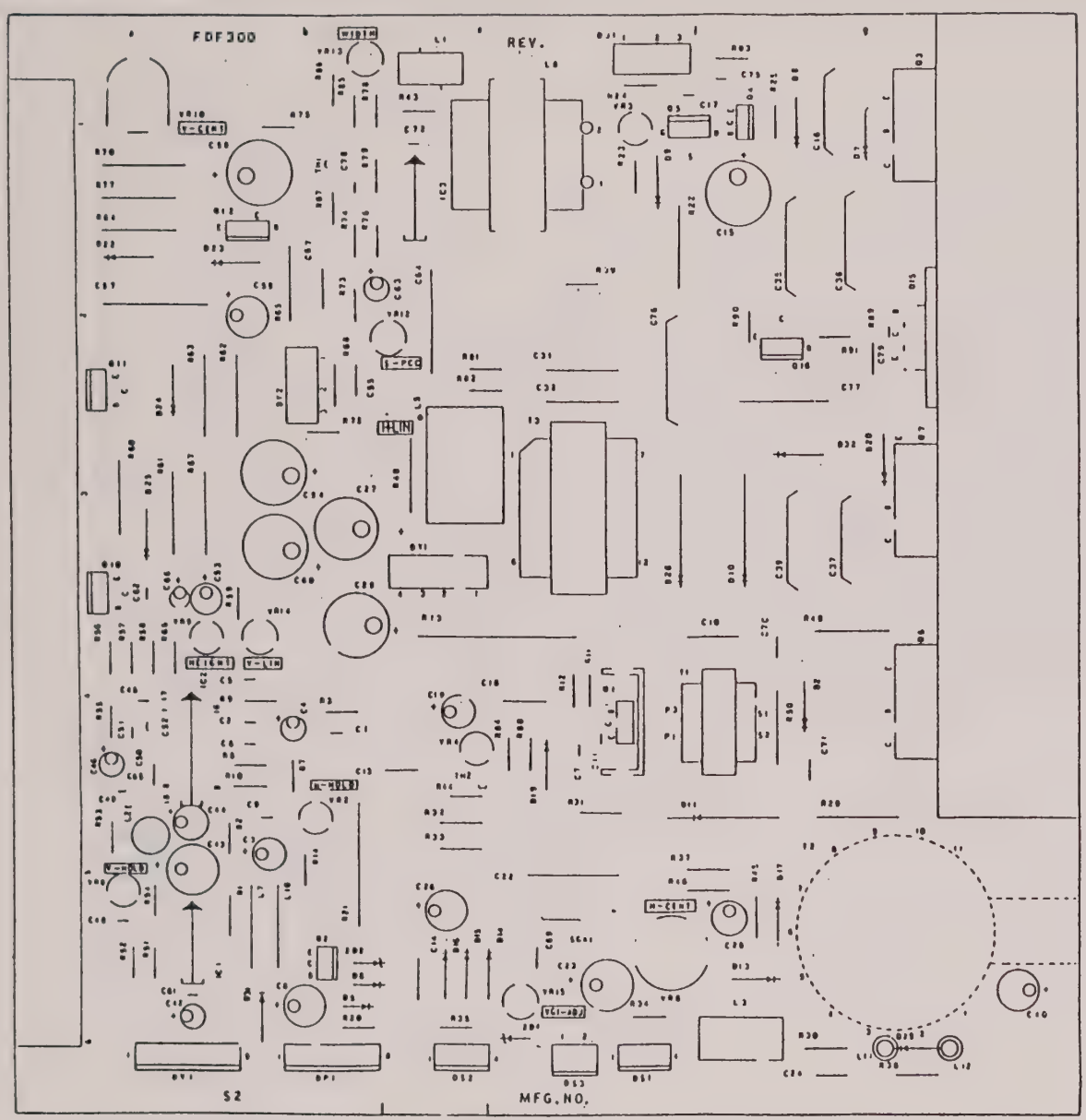
P.C.B PARTS LAYOUT

FVD300	.....	331DX31877
FCS200	.....	331DX31878
FDF300	.....	331DX31878
FPS300	.....	331DX31879

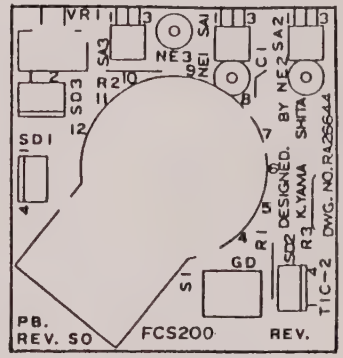


DWN	A. ISOBE	M 3·2		TITLE	REV.
CHKD	K. TOMITA		R13.2	PARTS LAYOUT	
APPD	T. YOSHIDA				PAGE
Hitachi, Ltd. Tokyo Japan			OMIKA WORKS DWG. NO	331DX31877	

FVD300

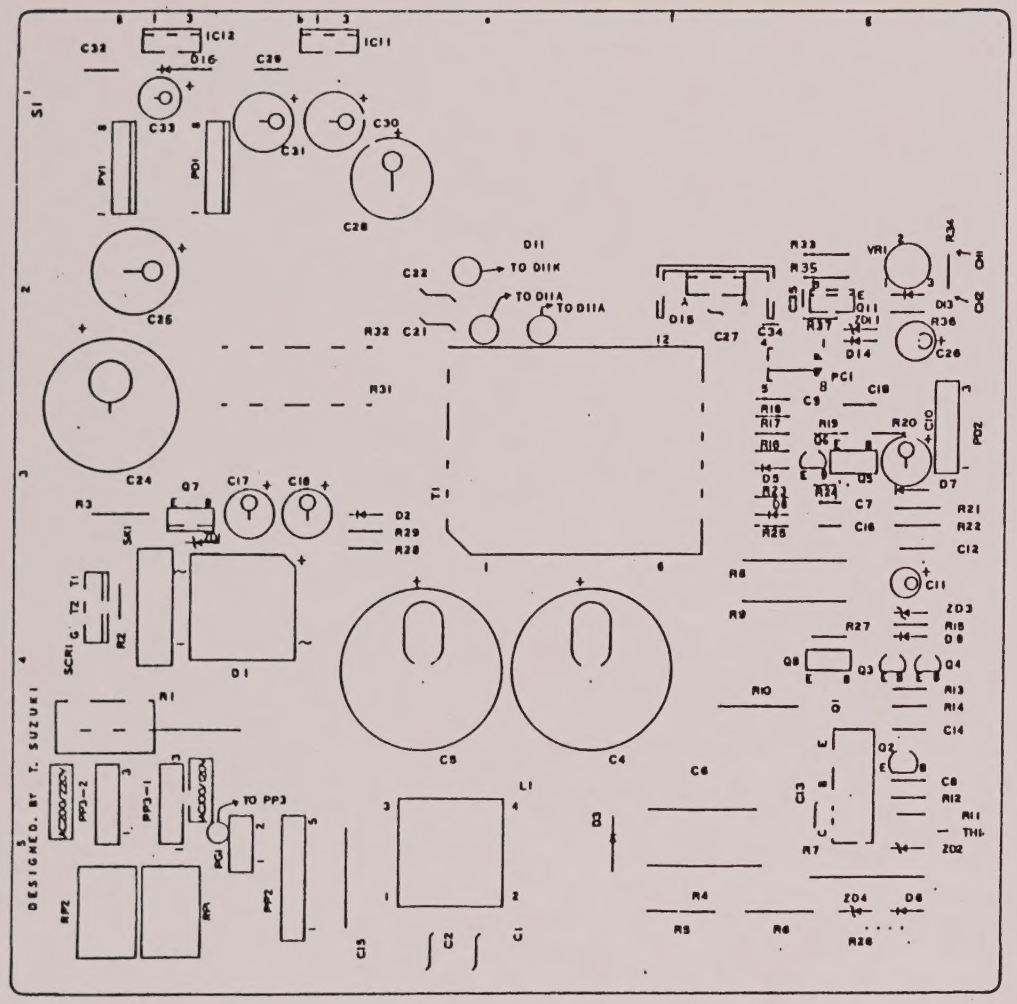


FDF300



FCS200

DRN	A.ISOBE	84.3.2		TITLE	REV.
CHKD	K.TOMITA			PARTS LAYOUT	
APPD	T.YOSHIDA				
Hitachi, Ltd. Tokyo Japan			OMIKA WORKS DWG NO. 331DX31878		PAGE



FPS300

DRN	A.ISOBE	84·3·2		TITLE	REV
CHKD	K.TOMITA	· ·		PARTS LAYOUT	- 1 -
APPD	T.YOSHIDA	· ·			PAGE
Hitachi, Ltd. Tokyo Japan				OMIKA WORKS DWG NO 331DX31879	